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TANNING
IN THE
UNITED STATES
TO 1850







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FRANK A. TAYLOR

Director, United States National Museum



SIXTEENTH-CENTURY TANYARD

Woodcut from Hans Sacks, *Eygentliche Beschreibung aller Stände . . . mit kunstreichen Figuren* by Jost Amman. Frankfurt, 1568. From the Collections of the Library of Congress.

TANNING
IN THE
UNITED STATES
TO 1850

A Brief History

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MUSEUM OF HISTORY AND TECHNOLOGY

SMITHSONIAN INSTITUTION

WASHINGTON : 1964

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PETER C. WELSH

TANNING
IN THE
UNITED STATES
TO 1850

Fig. 1. TANNING-ENGINE
and MILL .

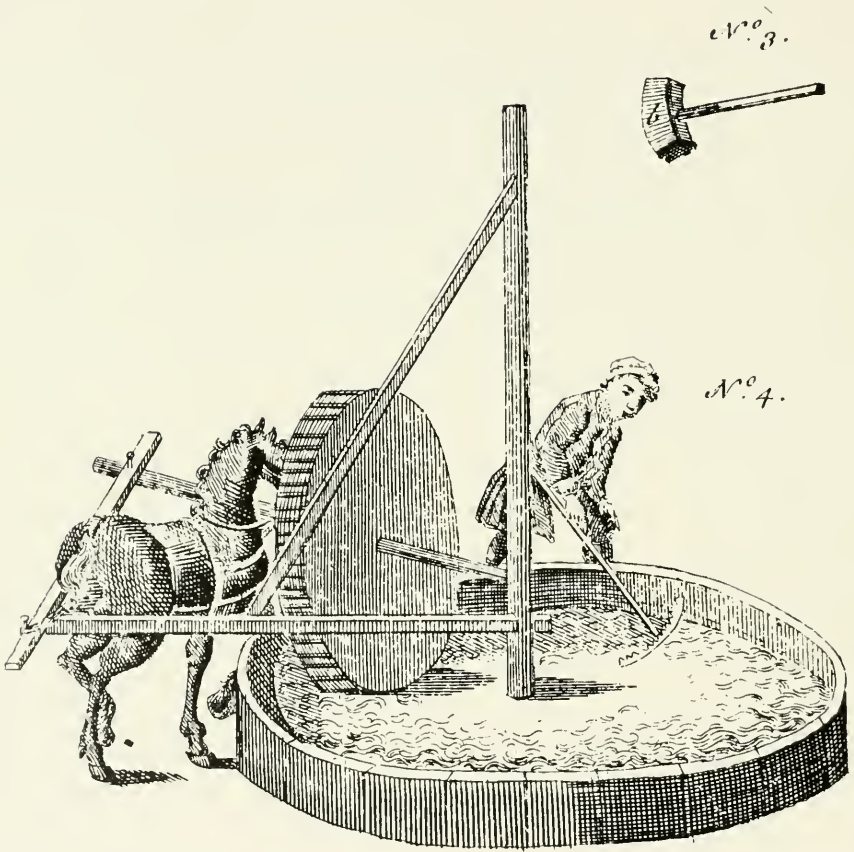


Figure 1.—Grinding Bark, Mid-18th Century. The bark mill illustrated in *A New and Complete Dictionary of the Arts and Sciences* published at London in 1764 suggests the simplicity of tanning techniques. American experience introduced little change.

Chapter I

A Basic Industry

"The tannery did not usually . . . tarry long behind the first occupants of a new town."

—J. Leander Bishop, 1861

Now that most of the necessities of life are mass-produced, it is difficult to imagine an earlier period in which artisans and craftsmen meticulously shaped a variety of raw materials into useful goods. Shoes, boots, aprons, and harness, all were needed, and it was the tanner's task to produce the leather of which these articles were made.

The mysteries of the tanner's art had evolved from antiquity, and by the 11th century leather production had been reduced to well-established techniques, but the chemical principles involved were not defined until the 19th century. The tanner, unlike the flour miller or the iron founder, was slow to utilize power-driven machinery (see fig. 1); yet leather played an important part in many early machines, and it was just as essential to everyday life in the New World as it had been in the Old.¹

Just how essential to everyday life was America's early leather industry? Tench Coxe provided an impressive summation in 1812 when he wrote: "The uses of leather are of the utmost importance to health, the facilitation of industry, the diffusion of knowledge, and the military operations of the United States by land and sea." Coxe's list of the uses of leather contained only "real necessities or plain conveniences." Of these it named "shoes, boots and slippers, saddles and bridles, harness, carriages (many of which have leather boots, tops, curtains, and aprons), drums, gloves, leathern breeches, rigging and other hides for ships and vessels, bound books, manufacturing cards and carding machines, military equipments, and other leather goods."

In addition, Coxe notes, the tanner's essential place in society was strengthened by the significant fact that "the manufacture of hides and skins are of great importance to agriculture." For example, "bark, abundant every where, is redundant in new settle.

¹ WATERER, "Leather," pp. 147-187 in vol. 2 of *History of Technology*; BISHOP, *History of American Manufactures from 1608 to 1860*, vol. 1, pp. 424-464; Charles H. McDermott, ed., *History of the Shoe and Leather Industries of the United States*.

ments, where the tanning business facilitates the destruction of the forests, which obstruct agriculture." The embarrassment of riches augured well for the future of an industry, if not for the conservation of resources. Here, then, neatly told by Coxe stood a century and a half of leather-making experience in America—a basic industry, meeting the needs of an essentially agrarian society; and it had been precisely so ever since the arrival of the first settlers.²

In the first settlements, along with sawmills, gristmills, and other machinery, a need for the leather crafts had soon developed. Hides were available everywhere either as a result of the fur trade or from the slaughter of domestic animals. In Virginia alone by 1649 there were twenty thousand head of cattle along with two hundred horses, three thousand sheep, five thousand goats, and many swine; and from "A Perfect Description of Virginia," as transcribed by Peter Force, it is apparent that tanning was a common practice carried on at all well-managed plantations.³ In addition to a steady supply of hides from colonial farms, tanning was further aided by the forests which provided quantities of excellent tanbark.

Natural conditions were abetted by colonial legislators who encouraged the manufacture of leather. Virginia, in 1680, ruled that tanhouses be erected in every county with tanners, curriers, and shoemakers provided to convert hides into leather. By 1682, Virginia forbade the export of any "wool fells, skins or hides, or any manner of Leather, tanned or untanned, or any deer, ox, steer, bull, cow or calf . . . except only such hides . . . as shall appear by the oath of the owner that it is to be directly transporting to some tan house . . . to be wrought-up."⁴ In other colonies legislative action promoted the making of leather. Maryland, in 1681, placed an export duty on leather and hides hoping to encourage tanning and shoemaking.⁵

In the northern colonies at this time, leather manufacture was a well-established branch of domestic industry. Public records

² COXE, *Statement of the Arts and Manufactures of the United States of America for the Year 1810*, part 1, pp. xiv, xv.

³ Force, compil., *Tracts and Other Papers Relating Principally to the . . . Colonies in North America*, vol. 2, no. 8, pp. 3, 7-8.

⁴ Hening, ed., *The Statutes at Large; Being a Collection of All the Laws of Virginia*, vol. 2, pp. 471, 476, 494.

⁵ Kilty, ed., *Laws of Maryland*.

and local histories attest the early beginnings of leather manufacture in New England, where well before 1650 tanneries were being operated at Lynn, Salem, Boston, Charlestown, Watertown, and Newbury.⁶ In 1642, Massachusetts passed the first regulatory law governing the production of leather and appointed searchers in every town that supported a tannery.⁷ Connecticut as well as Massachusetts attempted to control its tanneries and to regulate by legislation the unpleasant aspects of the craft. The price of raw hides and finished leather was fixed, and the depositing of foul-smelling animal remains in "tann hills" was forbidden, a regulation most likely impossible to enforce.⁸

By 1653, a New England tanyard, tanning West Indian hides, was valued at \$2000.⁹ But the domestic hides were more important than the imports, since the early leather business was dependent on stock husbandry. In mid-17th-century New England, "Towns began to increase roundly" and Edward Johnson in his *Wonder-Working Providence* noted the increasing "trade by sea" and the flourishing conditions of tanners and shoemakers who seemed capable of producing leather in quantities and at prices beyond what they had commanded in England. The leather workers were high on Johnson's list of those whose labors had turned "one of the most hideous, boundless and unknown Wilderesses in the world" into "a well-ordered Commonwealth."¹⁰ Two

⁶ Shurtleff, ed., *Records of the Governor and Company of the Massachusetts Bay in New England*, vol. 1, pp. 238, 256; vol. 2, pp. 18–20, 31, 168, 215–216; vol. 3, pp. 11, 85, 225; vol. 4, part 1, pp. 41–42, 93; vol. 4, part 2, pp. 147, 303, 513, 564. COFFIN, *Sketch of the History of Newbury, Newburyport, and West Newbury*, p. 52. HOUGHTON, "Leather, Tanned, Curried, and Finished," p. 703 in vol. 9 of *Twelfth Census . . .* (1900). BRYANT, *Shoe and Leather Trade of the Last One Hundred Years*. DEWSON, *Tanning Industry of the South Shore of Massachusetts*, p. 6. "Town Records of Salem, 1634–1659," pp. 89–90 in vol. 9 of *Historical Collections of the Essex Institute*. LEWIS and NEWHALL, *History of Lynn*, vol. 1, p. 112. HOOVER, *Location Theory and the Shoe and Leather Industries*, p. 126.

⁷ *Records of the Governor and Company of the Massachusetts Bay*, vol. 2, p. 19.

⁸ Trumbull, ed., *Public Records of the Colony of Connecticut*, vol. 1, pp. 285–287. Connecticut's first action (p. 60) to govern the supply and dressing of hides occurred in February 1640. See also vol. 2, p. 325; fol. 3, pp. 14, 23, 236; vol. 4, pp. 74–75, 82–83. See Phillips, compil., *Town Records of Derby, Connecticut, 1655–1710*, pp. 219, 262; and Dexter, ed., *Ancient Town Records: New Haven . . . 1649–1684*, vol. 1, pp. 131, 159, 161, 189, 219, 338, 366; vol. 2, p. 50. The General Court at New Haven in these years heard with great frequency complaints against Jeremiah Osborne, the town tanner; accusations included the sale by Osborne of spoiled and poorly tanned leather and the unlawful felling, on the Commons, of trees for tanbark. By 1653 New Haven hides and leather were commodities of trade between the town and "Vergenia and other places."

⁹ CLARK, *History of Manufactures in the United States*, vol. 1, p. 167. Cites the Suffolk Probate Records.

¹⁰ In *Original Narratives of Early American History . . .*, ed. J. F. Jameson, p. 248.

hundred years later, in the 1840's, John Finch, an ardent Owenite, unequivocally stated that "tanners, curriers, and leather-cutters will find more employment in the State of Massachusetts than in any other."¹¹

In New York, as in New England, tanning was encouraged—first by the Dutch and later by the English. Ten Eyck is the best known of the early New York tanners, and by the 1660's he and several associates had laid down tanpits and built a bark mill—an adjunct of tanning that begins to be mentioned in the 1660's,¹² although probably in use before that date.

Laws passed in New York regulated as well as encouraged the tanning trade and Governor Andros in 1676 gave to the colony's tanners and leather workers a trade monopoly stipulating that:

no butcher be permitted to be [a] currier, shoemaker, or tanner; nor shall any tanner be either [a] currier, shoemaker, or butcher; it being consonant to the laws of England and practice in the neighbor Colonys of the Massachusetts and Connecticut.¹³

The endeavors of Ten Eyck and other early tanners were in a locality referred to as the "Swamp"—an area historically associated with the leather trade of New York City.¹⁴

In nearby New Jersey the demand for food products in the markets of New York and Philadelphia stimulated stock raising which, in turn, yielded a large number of hides for tanneries at Newark, Trenton, and Salem. An abundance of hides, plus large quantities of bark, made New Jersey one of the leading leather-producing colonies. As early as 1681 an anonymous account of West Jersey had cited the propensity of the colonists there to "Tan Leather" as well as to "make Shooes and Hats."¹⁵

William Penn's account of the "Province of Pennsylvania" in 1681 echoed the sentiments of the region's first administrators, the royal governors of New Sweden. It listed hides among the "Commodities that the Country is thought to be capable of" and tanners among the several representatives of the "Laborious Handi-

¹¹ Commons, ed., *Documentary History of American Industrial Society*, vol. 7, p. 65.

¹² BISHOP, vol. 1, p. 440. STOKES, *Iconography of Manhattan Island, 1498-1909*, 6 vols. In- dispensable guide to location, dates and owners of early New York City tanneries and bark mills.

¹³ BISHOP, vol. 1, p. 441. See also *Colonial Laws of New York from the Year 1664 to the Revolution*, vol. 1, pp. 71-73, 193, 266-268.

¹⁴ NORCROSS, *History of the New York Swamp*.

¹⁵ Myers, ed., "Present State of the Colony of West-Jersey, 1681," p. 191 in *Narratives of Early Pennsylvania, West New Jersey and Delaware, 1630-1707*. See also WEISS, *Early Tanning and Currying in New Jersey*.

crafts" most fitted for life in the new province. Two years later, in a letter to the Free Society of Traders, Penn reported a tannery at Frankford so plentifully supplied with bark that only God's blessing was required to assure its "Reputation and Profit." And in 1685, in a "Further Account" of his proprietary, Penn enumerated among the colony's useful tradesmen, tanners, shoemakers, glovers, and fellmongers. Gabriel Thomas' account of Pennsylvania in 1698 specifically mentioned tanners and gave an exact prospectus of the business. "Tanners," wrote Thomas, "may buy their Hides green for Three Half Pence per pound and sell their leather for Twelve Pence per pound," while the currier, whose job it was to finish the leather, received "Three Shillings and Four Pence per Hide for Dressing it." Francis Daniel Pastorius, with his flock suitably settled at Germantown, also appraised the advantages of tanning; hides were abundant "indeed two raw for one dressed," and there seemed every likelihood for "great profit."¹⁶ In the fast-growing city of Philadelphia the early tanyards were on Dock Creek where, by 1739, six were in operation.¹⁷

Pennsylvania as well as New York by 1700 had passed laws to insure the quality of leather. These statutes prohibited the sale of an ill-tanned product and in addition fixed and controlled prices. In 1721 another act, for "The Well Tanning and Currying of Leather," was passed by the Pennsylvania legislature and, like most laws dealing with industries closely connected to the public welfare, it was restrictive. The pattern of close governmental control continued throughout the 18th century, as well as the extremely simple production methods employed even in the very best leather factories. The regional characteristics that affected other institutions from New England to Georgia had little effect on the appearance of tanvats, beaming sheds, or bark mills, and only the use of the tanning agent—hemlock bark in the north and oak bark in the middle and southern provinces—varied from place to place.¹⁸

¹⁶ Myers, ed., "Some account of the Province of Pennsylvania," pp. 207, 209, 241n, 261, 327, 409, in *Narratives of Early Pennsylvania*

¹⁷ BISHOP, vol. 1, p. 445.

¹⁸ Mitchell and Flanders, eds., *Statutes at Large of Pennsylvania from 1682 to 1801*, vol. 2, pp. 90-91; vol. 3, pp. 257-263. CLARK, *History of Manufactures* . . . , vol. 1, pp. 32-72; shows effect of colonial legislation on manufactures. Hening's *Statutes at Large*, vol. 3, pp. 75-80; good elaboration of official interest and control in another colony at about the same period as the *Records of the Governor and Company of the Massachusetts Bay*, and the *Public Records of the Colony of Connecticut*. HOOVER, *Location Theory and the Shoe and Leather Industries*, pp. 130-132; defines the oak and hemlock forest regions

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BARK MILL

T. W. Pryor

Fig 25

Patented 21st May 1865.

- A. Cylindrical Wire Sieve
- B. Chute
- C. Reverses for pieces of Bark not square cutly for use
- D. 1st Wheel geared to main Wheel A.
- E. 2nd Wheel. G. Bark Stone



Patent Office March 29th 1865

Class in accordance with the direction of the Commissioner of Patents
in conformity with Act 5th March 1837

Thos. L. Blinn

Figure 2.—Pryor's Bark Mill. This patent drawing of May 21, 1865, reveals that the earliest mechanical adjunct of leather manufacture had remained basically unchanged from 1660. John Bigelow in 1842 described a mill in which bark was either "cut with knives, beaten with hammers, and ground with stones or cylinders," but even then the bark mill used by the American tanner retained its early form.

This widespread abundance in tanning essentials is illustrated by a 1731 description of South Carolina that primarily bemoaned the Colony's lack of skilled artificers but at the same time stressed the plentitude of tanning materials. Most leather goods, according to the author, came from England, and the reasons: "Not but that they have Hides enough, and very cheap, an Ox's Hide being sold for 20s. neither are they destitute of the Means to Tan them; for they make very good Lime with Oyster-shells, and the Bark of Oak-trees is so plentiful, that it costs nothing but the trouble of gathering." Unlike the settlements to the north, the South Carolinians of the 18th century lacked "a sufficient number of good Tanners and Shoemakers."¹⁹

In most areas trade quickened after 1700, and where leather workers were plentiful the extended commerce brought increased quantities of hides, imported to supplement the domestic supply either from the West Indies, Lisbon, the Azores and Canaries, or, much later, directly from South America. The term "Spanish" or "Barcelona" or "Buenos Aires" as applied to hides became the common nomenclature in importers' advertisements. Tanners in the vicinity of seaport towns eagerly scanned notices of ship arrivals, hoping to strike a bargain for a cargo of heavy hides in exchange for a consignment of finished leather.²⁰

Knowledge of Old World developments came to America either firsthand or in books. The secrets of the tanner, although omitted from Moxon's *Mechanic Exercises or Doctrines of Handy-Work*,²¹ had already received some attention by the Royal Society in 1674.²² Perhaps a few colonists knew of the *Transactions* or of the various dictionaries of the arts and sciences that followed, such as the one published at London²³ in 1764. English works were not the only accounts of the trade, or necessarily the best, particularly when compared with the "Art du Tanneur," so fully described and illustrated by Jérôme Lalande for Duhamel's *Descriptions des Arts et Métiers*, or with Diderot's encyclopedic coverage

¹⁹ Commons, ed., *Documentary History*, vol. 2, p. 175, "Description of the Province of South Carolina drawn up at Charlestown in September, 1731." Force, compil., *Tracts*, no. 11, p. 7.

²⁰ Advertisement of Broom, Hendrickson, and Summerl in *Delaware Gazette*, Wilmington, October 13, 1792. See also HOOVER, *Location Theory and the Shoe and Leather Industries*, chapt. 8.

²¹ The 3rd edition, 1703.

²² "Brief Directions How to Tan Leather according to the New Invention of the Honourable Charles Howard of Norfolk," *Philosophical Transactions of the Royal Society* (1674), vol. 9, pp. 93-96.

²³ *New and Complete Dictionary of the Arts and Sciences; Comprehending all the Branches of Useful Knowledge*, 4 vols.

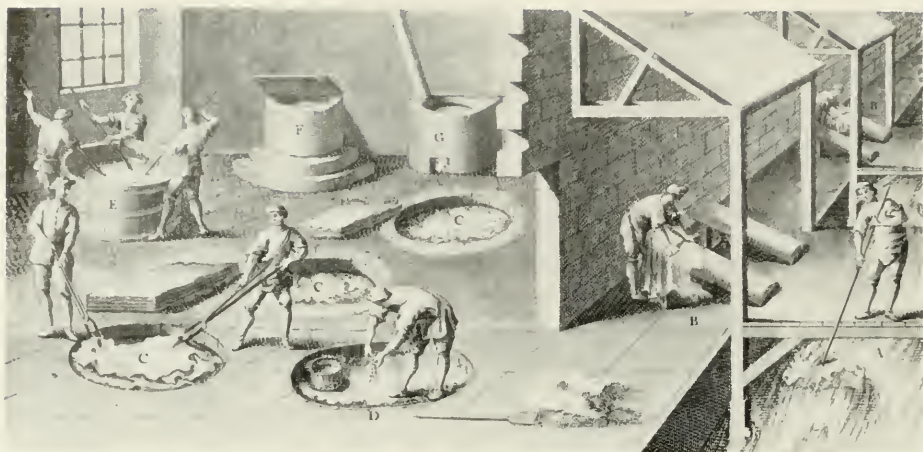


Figure 3.—“Art du Tanneur,” 1764. The 18th century’s most definitive investigation of the manufacture of leather was provided by Jérôme Lalande’s “Art du Tanneur,” compiled for Duhamel’s *Descriptions des Arts et Métiers*.

of the leather industry of mid-18th-century France ²⁴ (see fig. 3).

Later, recognition of the tanner came from a growing number of do-it-yourself books everywhere available before 1840. Some, like Edward Hazen’s *Panorama of Professions and Trades*, were “written for the use of Schools and Families,” conceivably to interest children in careers as tanners, or in other useful endeavors.²⁵ A few, like the *Book of Trades*, first published in America in 1807, were popular in scope, but the illustrations must have seemed lacking to anyone with a superficial knowledge of a special craft, even children ²⁶ (see fig. 4). Others, however, were extremely useful and presented detailed texts that approached the level of the modern technical journal, if not in content, at least in tone. Thomas Martin’s *Circle of the Mechanical Arts*, published in 1813, is a good example; and his treatment of tanning as one of “the arts connected with, or depending upon, or, at least, which

²⁴ See also *Encyclopaedia: or, a Dictionary of Arts, Sciences, and Miscellaneous Literature*; REES, *Cyclopedia; or, Universal Dictionary of the Arts, Sciences, and Literature*; and Shaw, compil., *Engineering Books Available in America Prior to 1830*.

²⁵ HAZEN, *Panorama of Professions and Trades*, vii, pp. 60–67.

²⁶ *Book of Trades*, vol. 1, pp. 91–97, 223–231.



Figure 4.—Tanning and Currying: The Popular Image.

After 1800, many works like the *Book of Trades* stressed the virtues of an industrious life but proved of little value as technical guides to the arts and crafts.

are materially benefited by the principles of modern Chemistry," pointed the way to an entirely new concept of an ancient craft and reflected the contemporary work of men like Sir Humphry Davy.²⁷

But none that followed the encyclopedist prior to 1840 was more philosophical in his approach to the status of those employed in the basic industries than the writer-chemist Andrew Ure. The preface to his *Dictionary* must have been most appealing to an egalitarian United States. Here was a work intended "to instruct the Manufacturer, Metallurgist, and Tradesman, in the principles of their respective processes, so as to render them in reality the masters of their business, and to emancipate them from a state of bondage to such as are too commonly the slaves of blind prejudice and vicious routine."²⁸ Ure's words, so pleasing to the general public, must have been small compensation to the tanner for the hours of toil amidst the fleshings and remainders that littered the tanyard.

The establishment of a national government continued an official interest in the status of domestic industries akin to that first shown by colonial proprietors and later by crown officials, and after 1790 the leather industry begins to take shape statistically; the picture derived, although spotty, is one of great decentralization and ancient practice. Alexander Hamilton compiled his "Report on Manufactures" on the basis of reports submitted from New England, the Middle States, and the South; and every reporter from Connecticut to the Carolinas mentioned the manufacture of leather. He learned that "thro'out" Middlesex County, Connecticut, there were tanners enough to "supply Leather for almost if not quite every Use, for which it is wanted." Rhode Islanders on the other hand complained that increased West Indian imports depressed leather production in local tanneries; but in Pennsylvania, New Jersey, and Delaware, tanners were "very prosperous" indeed. At Norfolk in Virginia there was "a very extensive Tannery" that supplied the town and much of the back country as well, and on every plantation in the Old Dominion the owners tanned what was needed to supply "the slaves shoes for winter." From South Carolina, Hamilton heard an oft-repeated story: precisely as had been the case in the 1730's, there were in 1791 still too few skilled workmen to make a success of the State's leather

²⁷ MARTIN, pp. 542-546.

²⁸ URE, *A Dictionary of Arts, Manufactures and Mines*, pp. 4-5.

industry. This condition, however, was an exception, for Hamilton listed tanning first among the industries that flourished in the United States and capped this summary by announcing that there were "scarcely any manufactories of greater importance."²⁹

Following the pattern set by Hamilton, the Government solicited data for Albert Gallatin's "Report on Manufactures,"³⁰ for the first census of manufactures (in 1810) and the next (in 1820),³¹ for the McLane Report in 1832,³² and for the census of 1840.³³ With each enumeration, information became more voluminous and progressively more accurate and meaningful. Although the strict statistical value of the several reports was marred by error and inconsistencies, the raw material gathered for analysis frequently contained detailed descriptions of manufacturing processes not readily available elsewhere.

Obviously the several reports are prime sources, indicative of manufacturing in general and tanning in particular; and when equated collectively, along with the census of 1840 and its rough estimate of 8229 tanneries in the United States, the picture of the early leather business is more sharply focused. In the report, even if but partially complete, is firsthand evidence of a widely scattered industry, with small operations taking place in small towns and employing mostly local labor. J. Leander Bishop captured the essence of this when he wrote that the tannery—

was a necessary appendage to every village, as communication between places was imperfect, and Leather perhaps relatively a greater dependence than in our time. Transportation and travel in new settlements were exclusively by means of packhorses. As roads became improved, the heavy and cumbersome four-horse wain became the medium of transport. The gear and equipments of these conveyances required frequent renewal For various other purposes in Agriculture and the mechanics Arts, Leather was much depended upon. The cost of freight from the seaports to the interior, and of hides thence to the older maritime towns, was saved by the early establishment of a tannery by some member of each new community

²⁹ Cole, ed., *Industrial and commercial correspondence of Alexander Hamilton, Anticipating His Report on Manufactures*, pp. 25, 82, 117, 96, 93, 90-91, 279, 305.

³⁰ *American State Papers* . . . , Finance, vol. 2, p. 425.

³¹ *American State Papers* . . . , Finance, vols. 2 and 4.

³² McLane, compil., *Documents Relating to the Manufactures in the United States*, Executive Documents, 22nd Cong., 2nd sess., No. 308, Washington, 1833. Hereinafter cited as McLane Report. As a descriptive account of individual manufactories this source is invaluable.

³³ *Statistics of the United States of America*, 1841; GEORGE TUCKER, *Progress of the United States, and Eighty Years Progress of the United States*.

Tanneries, however, in Pennsylvania, New Jersey, and several parts of New England soon became very numerous. The cheapness of hides and of bark, furnished in the process of clearing land, the abundance of suitable streams for carrying it on, and the demand for Leather . . . rendered the business profitable. The operations were conducted in a routine way, with little regard to the chemical principles involved, and the usual amount of technical skill was soon acquired.³⁴

Nor should this failure to apply new techniques in any way diminish the tanner's historical importance, since the leather industry, unlike others, remained largely unaffected by the machine. Thus, as late as the 1840's, tanning continued to be a craft that functioned chiefly as an adjunct of an agricultural society. What were the techniques of this omnipresent but highly decentralized craft? Before looking at tanning in one State, Delaware, and examining the fate of one tannery, A. Cardon & Co., let us review the techniques that produced a leather that was "probably equal to that of any European country except England."³⁵

³⁴ BISHOP, vol. 1, pp. 445-446.

³⁵ Ibid., p. 453.

Chapter II

The Techniques of Tanning

"It is generally a manufacture *by hand*, and not machinery."—*Tench Coxe, 1812*

In a special report on the American leather industry nearly a century after Coxe, George C. Houghton concluded that not until about 1880 had tanners to any degree attempted to replace manual labor with machinery; and, even worse, many refused to avail themselves of the new methods proffered by the advent of modern chemistry and instead chose to follow the time-honored techniques "handed down for generations from father to son."³⁶ Nowhere are the reports of Coxe and Houghton more colorfully confirmed than in J. Leander Bishop's picturesque view of American tanning practice:

The rude appointments of a tannery [wrote Bishop] . . . embraced a greater or less number of oblong boxes or hogsheads sunk in the earth near a small stream, and without cover or outlet below, to serve as vats and leeches. A few similar boxes above ground for lime vats and pools, an open shed for a beam house, and a circular trough fifteen feet in diameter, in which the bark was crushed by alternate wooden and stone wheels, turned by two old blind horses, at the rate of half a cord a day, completed in most cases the arrangements of the tanyard.³⁷

Here was the typical tannery visualized by Houghton—simple, poorly equipped, and almost haphazard in arrangement. But America's tanning industry, despite such testimony, was not without progress. Change occurred, but it did so slowly and without the fanfare associated with the cotton gin or the clipper ship. Steam, for example, dramatic in its application to textile machinery, land transport, and watercraft, came late to the leather factory and, when it did, it was used most routinely "in grinding bark, for softening foreign hides, and in giving motion to many machines for washing, glazing and finishing leather"³⁸—in short, steam was quite unspectacularly applied to old techniques and not to new ones. Iron and steel were likewise of small consequence to the tanner, and the prospect of rapid transport seemed unessential to a process that required up to two years to transform raw

³⁶ "Leather Tanned, Curried and Finished," in *Twelfth Census*, vol. 9, p. 704.

³⁷ *Op. cit.* vol. 1, p. 453.

³⁸ GREAT EXHIBITION . . . 1851 *Reports by the Juries* . . . , p. 388.

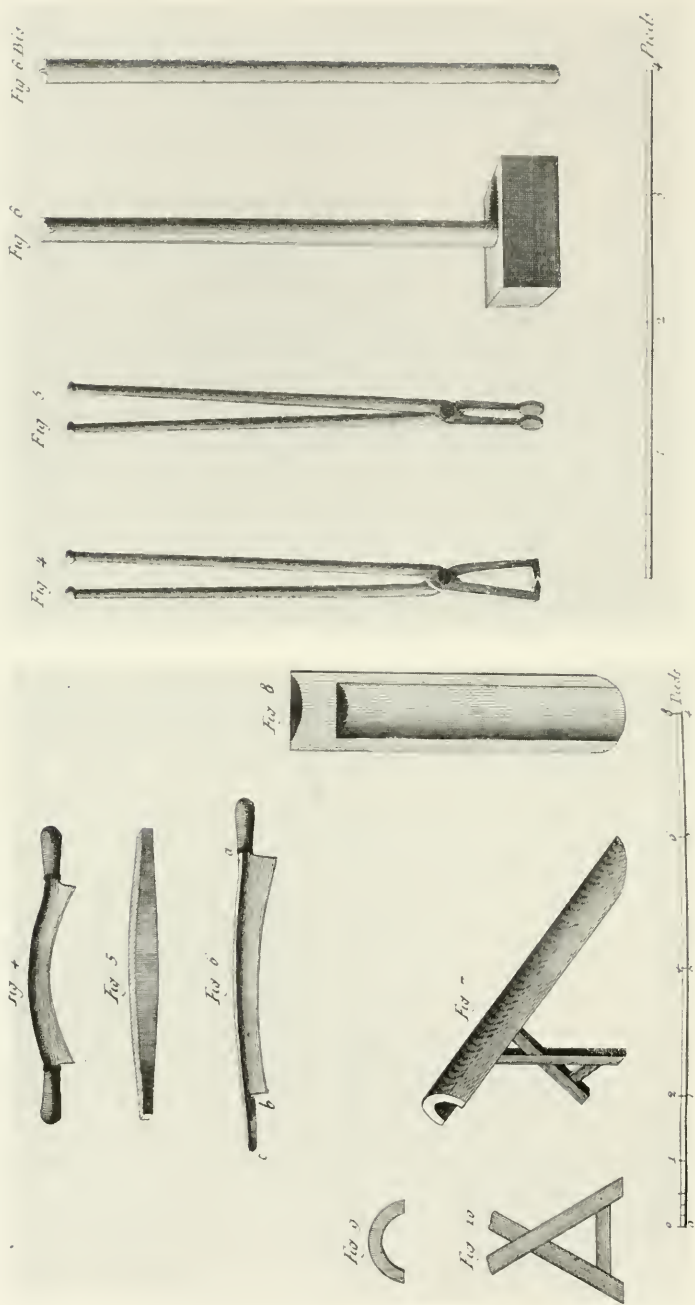


Figure 5.—Tanner's Tools: Beaming Knife and Beam, Tongs, Pincers, and Stirring Rod. Diderot, 1771.

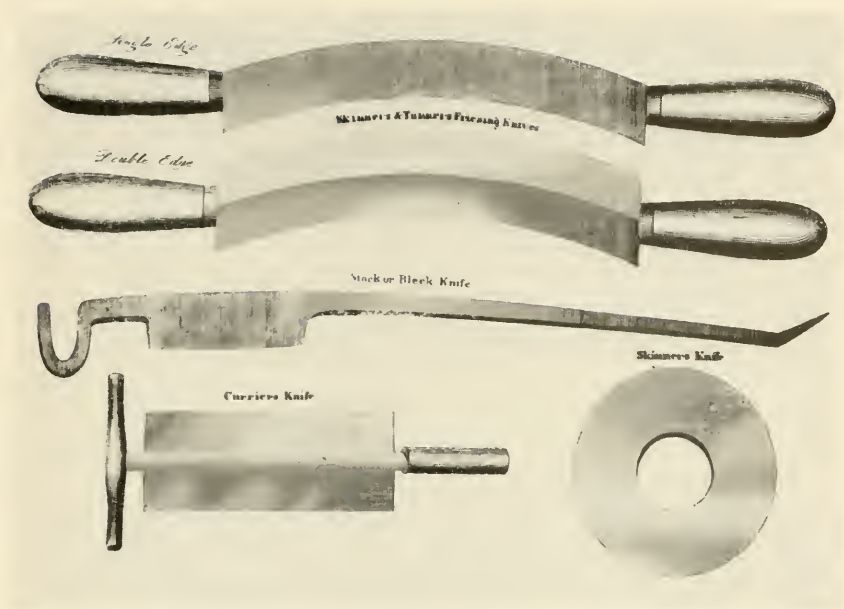


Figure 6.—Tanner's and Currier's Knives, ca. 1800. The leather workers' knives shown above are from Pattern and Design Book 87 of Furniss, Cutler and Stacey, Sheffield, England. Original in the Victoria and Albert Museum (M631).

materials into finished products. Lastly, as Siegfried Giedion suggests, the unsuccessful application of the machine to organic material, such as an animal's hide, proved vexing;³⁹ so much so that perhaps it is safe to conclude that, though ideas for improvement were prolific, accomplishment remained so remote that few commercial interests would disrupt their slow but successful methods merely to "modernize."

Some Americans, it is true, tried chemically and mechanically to speed and to ease the manufacture of leather, although generally it was from Europe that ideas for advances came. But what of the majority of tanneries? How, for instance, in their "rude appointments" amidst scattered hogsheads and blind horses was leather tanned? From the earliest times, the rudimentary facilities

³⁹ *Mechanization Takes Command*, pp. 229–232.

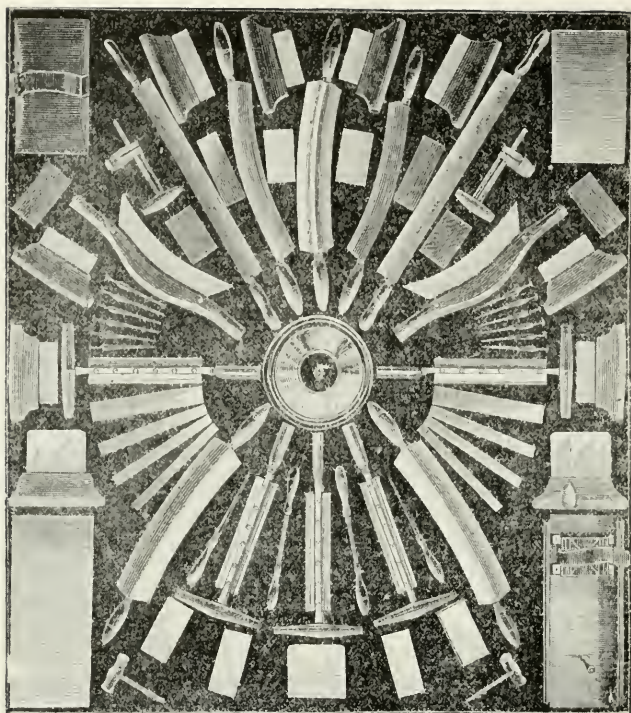


Figure 7.—Tanner's Tools, 1876. From Schultz, *The Leather Manufacture in the United States*.

for washing, fleshing, lining, beaming, tanning, and drying had been universally the same. What was true of the physical plant was also true of the tanner's tools: so long as the craft persisted as a manual operation, the basic tools—the beam, the fleshing knife, and the tanner's hook—remained unchanged (see figs. 5, 6, and 7). Even the bark mill, tanning's first mechanized accessory, showed little change, and grinding by horsepower continued far into the 19th century.

Odious, dirty, and no task for an aesthete, tanning as defined in the mid-18th century entailed "the preparing of skins or hides in a pit, with tan and water, after the hair has been first taken off, by putting the skins into lime-water."⁴⁰

To prepare a hide, the tanner practiced four regular operations: first, the preliminary washing, which took about 30 hours to clean

⁴⁰ *A New and Complete Dictionary of the Arts and Sciences*, vol. 4, p. 3154.

the skins; second, the longer processing to loosen the hair, soaking and scraping the skin, lasting a year; third, the tanning by immersing the dehaired hides in a bath of oak bark; and, finally, the drying and finishing of them to perfect the quality and appearance of the leather.⁴¹

The method of raising with lime was the oldest method of distending the pores and fibers in order to loosen the hair. In early tanneries milk of lime was the swelling agent, and it was contained in lime vats made either of wood or masonry. Lime vats were usually above the ground, were either round or square, and their size was "proportional to the number of hides to be soaked."⁴² The average square vat measured 125 cubic feet (5 feet on a side) with a peck of lime required for each large hide immersed. Normally the tanner used his vats in combinations of threes or in what was termed a raising series.

The vats are distinguished as *dead*, *weak*, and *live* vats. The *dead* vat is that which has been nearly exhausted of its strength; the *weak* is that which has only been used enough to deprive it of a portion of its force; and the *fresh* or *live* vat, is that which has not yet been worked. In the progress of operations, the live vat passes successively into the weak and the dead vat.⁴³

Raising with lime had disadvantages, however: first, it altered the texture of the hides by impregnating them with caustic lime, which was difficult to remove, and secondly, the lime impeded the action of the tan liquor, causing an improper combination of the tannin with the skin. In time, as a result of these disadvantages, American tanners tried other methods of raising—among them raising by acids, depilation by steam, cool sweating, and raising by barley dressings.⁴⁴

After being limed, the hides were beamed to remove any hair, surplus tissue, or fat (see fig. 8). When beaming a hide, the tanner made

a kind of pad of two or three folded skins, which he places upon the horse, and over which the skin to be operated upon is laid with the hair side up; and he then scrapes the surface strongly from above downwards, with the *scraper*. After the hair is completely removed, the skin is washed and soaked in a trough, or vat full of water, and is then subjected to the following operations. The flesh and other parts not properly belonging to the skin, are removed with a sharp knife called the *flesher*, and the skin is again washed and soaked in fresh water. The projecting filaments or shreds, and those parts of the borders of the skin which are thicker than the rest, are cut off

⁴¹ JULIA DE FONTENELLE and F. MALEPEYRE, *The Arts of Tanning, Currying and Leather Dressing*, edit. and transl. Campbell Morfit, p. 19. Hereinafter to be cited as Morfit.

⁴² Ibid., p. 162.

⁴³ Ibid., p. 163.

⁴⁴ Ibid., p. 168, et passim.

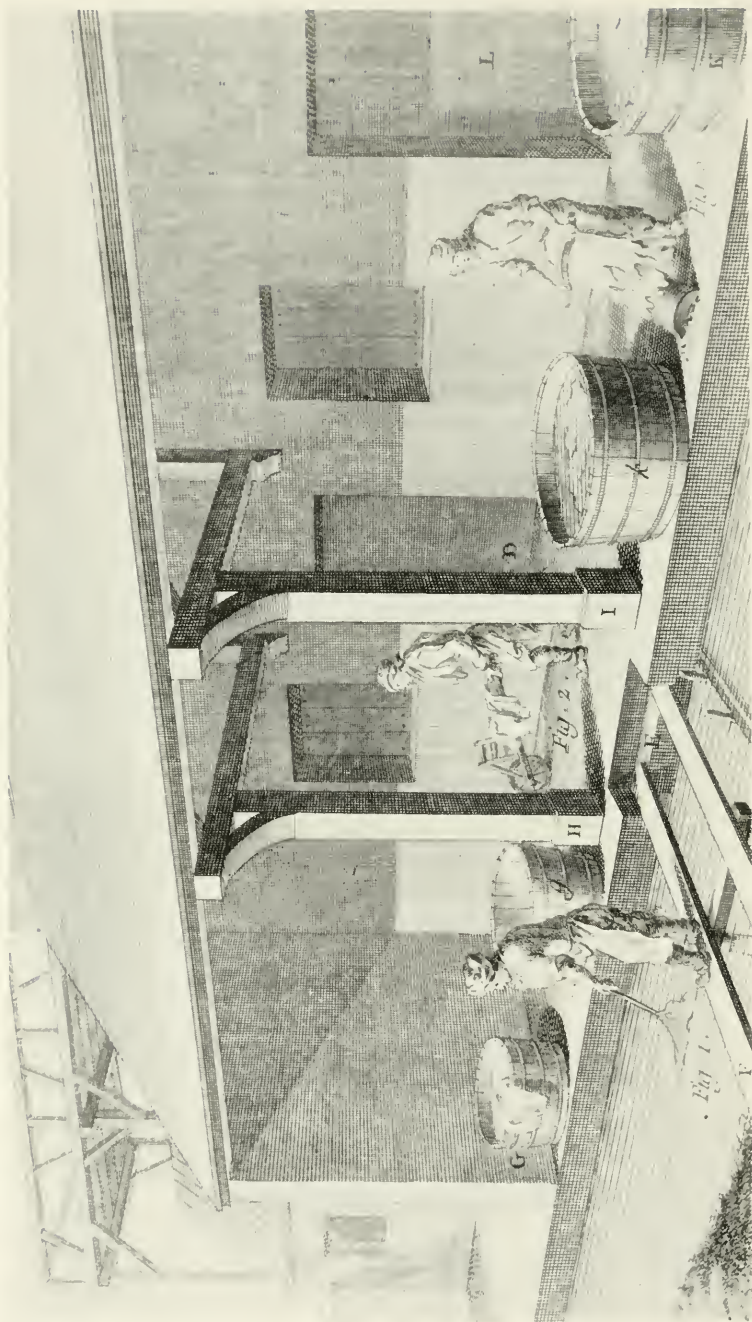


Figure 8.—The Beaming Shed. Diderot, 1771. In the tannery, working the beam proved the hardest and most loathsome of many unpleasant steps in the conversion of hides to leather. Few beaming sheds could boast the ordered neatness, free of filth and remainders, that existed in Diderot's engraving.

with a sharp knife, and the skin is again immersed in fresh water. . . . The hair side is then well rubbed and smoothed down with a stone, similar to that used for sharpening knife-blades, but which is set in a wooden handle. This done, the skin is dipped for the third time in fresh water. Both sides are well scraped and smoothed with a knife having a curved blade, so as to equalize the surfaces and remove all foreign particles.

This work was exhausting, and in the course of a day one man normally beamed only a dozen hides.⁴⁵

After the liming and dehairing but prior to beaming, hides were frequently placed in a vat containing a substance known as bate—a mixture of hen dung, salt, and water intended to restore the pliability of the hide. Immersion in the bate vat was followed by a thorough washing in pure and preferably soft water. In the preparation of skins (cow, calf, horse, or pig) the average duration of the liming process was four months.⁴⁶

With the preliminaries of washing, raising, and beaming over, hides were, in the parlance of the tanner, ready to be “put into tan”—a process that required several steps and much time, but one that was greatly improved by three men: David Macbride, Armand Seguin, and Sir Humphry Davy.

The ancient method of tanning was to fill a pit with alternate layers of prepared bark, hides, and water, then cover it. When placed in the tan pit, each hide required twice its weight in bark plus 12 gallons of water.⁴⁷ The hides at the bottom were always subject to the strongest action of the tan. Therefore, during the months that they lay immersed it was customary to shift them or handle them, so that over a given period each hide would be exposed to equal amounts of tannin. If three vat combinations were used, which as in liming was often the case, hides were moved from vat to vat, or from a solution of diminished strength to one that was more concentrated. It was estimated that to produce superior leather required twelve to eighteen months. The entire operation was terribly time consuming, and new methods were badly needed to shorten it without injuring the durability and beauty of the leather.

David Macbride, a Dublin physician, was one of the earliest to introduce a significant improvement in the method of tanning leather, and it is of interest to quote at length from his important

⁴⁵ *Ibid.*, p. 203.

⁴⁶ *Ibid.*, p. 164.

⁴⁷ *Ibid.*, pp. 208, 210.



Figure 9.
Preparing the Tan Pit

Manual labor, hard and frequently unpleasant, long characterized American as well as European tanning methods. These vignettes are from *The Art of Tanning, Currying and Leather Dressing* that appeared in Philadelphia in 1852, translated from the French by Campbell Morfit.



Figure 10.
Working the Beam

Figure 11.
Swelling the Hides



Figure 12.—Handling the Hides



essay because it not only outlines clearly the old, slow process common wherever leather was tanned, but also, in feeling, it conveys the retarded technical state of the leather industry in a country whose textile mills and foundries were the envy of the world. In presenting his findings to the Royal Society in 1778 Macbride wrote:⁴⁸

The tanners prepare their bark by gently drying it on a kiln, and grinding it into a very coarse powder. They then either use it in the way of infusion, which is called ooze, or they strew the dry powder between the layers of hides and skins, when these are laid away in the tan-pits.

The ooze is made of macerating the bark in common water, in a particular set of holes or pits, which, to distinguish them from the other hole in the tanyard, are termed letches.

The first operation of the tanner is to cleanse his hides from all extraneous filth and remove any remains of flesh or fat which may have been left behind by the butcher.

The hair is next to be taken off, and this is accomplished, either by steeping the hides for a short time in a mixture of lime and water, which is termed liming; or by rolling them up close, and piling them in heaps, where they quickly begin to heat and putrify. The hair being loosened, is scraped off, and the tanner proceeds to the operation called fleshing which consists in a further scraping with a particular kind of knife contrived for the purpose . . .

The raw leather is then put into an alkaline ley [bate], in order to discharge the oil, and render its pores more capable of imbibing the ooze. The tanners of this country generally make their ley of pigeon's dung . . . or potash.

The oil being sufficiently discharged, the leather is ready for the ooze, and at first, is thrown into smaller holes, which are termed handlers; because the hides and skins, during this part of the process, are taken up, from time to time, and allowed to drain; they continue to work the leather in these handlers, every now and then stirring it up with a utensil called a plunger, which is nothing more than a pole with a knob at the end of it, until they think proper to lay it away in the vatts. In these holes, which are the largest in the tanyard, the leather is spread out smooth, whereas they toss into the handlers at random, and between each layer of leather they sprinkle on some powdered bark, until the pit is filled by the leather and bark thus laid in *stratum super stratum*: ooze is then poured on, to fill up the interstices; and the whole crowned with a sprinkling of bark, which the tanners call a heading.

In this manner the leather is allowed to macerate, until the tanner sees that it is completely penetrated by the ooze: when this is accomplished (which he knows by cutting out a bit of the thickest part of the hide) the manufacture is finished, so far as relates to tanning, since nothing now remains but to dry the goods thoroughly, by hanging them up in airy lofts built for that purpose. Such in general is the process for tanning calf skins and those of lighter sorts of hides which are called butts; but the large,

⁴⁸ MACBRIDE, "Instructions to Tanners," *Philosophical Transactions of the Royal Society* (1778), vol. 68. The paper was delivered by Sir John Pringle in 1778, and the essay appeared subsequently in the *Repertory of Arts and Manufactures* (1795), vol. 2, pp. 341-354, 382-388.

thick, heavy hides, of which the strongest and most durable kind of soal-leather is made, require to have their pores more thoroughly opened before the ooze can sufficiently penetrate them. For this purpose, . . . they are thrown into a sour liquor, generally brewed from rye, in order that the effervescence which necessarily ensues may open the pores.

The tanners term this operation raising, as the leather is considerably swelled, in consequence of the conflict between the acid and alkali. This is an English invention; for it appears from M. de la Lande, who was employed by the Royal Academy of Sciences to write on the art of tanning, that the foreign tanners know nothing of this branch of the business: indeed, their whole process, according to his account, is slovenly, and even more tedious than our common method, and must make but very indifferent leather.

When the raising is accomplished, the leather is put into the handlers, and worked in them for the requisite time; then laid away in the vatts, and there left to macerate until the tanning is found to be completely finished which, for the heaviest kind of leather, such as this of which I am now speaking, requires from first to last full two years. At least, the tanners of this country cannot make soal-leather in less time; what they are able to perform in England, I am not so thoroughly acquainted with.

It is this tediousness of the process which enhances the value of leather; and the returns being so slow, the trade of tanning never can be carried on to advantage, but by persons possessed of a large capital; therefore, one sure way of increasing the number of tanners, and of course of bringing down the price of their manufacture, is to shorten the process; and if at the same time we can improve the quality of the leather, and save somewhat in the expence of tanning materials, the public will be essentially benefited in respect to one of the necessary articles of life.

All this, I will venture to say, can be done by pursuing the method which is laid down in the inclosed paper, and which may be introduced into any common tanyard.

With respect to time it is possible, in the way that I have found out, to finish leather in a fourth part of what is required in the ordinary process; for I have repeatedly had calf-skins tanned in a fortnight or four weeks, which in the common way would not be done in less than from two to four months.

I shall not pretend, however, to affirm, that that business can be carried on in the large way with such expedition; because a great deal of this abridgement of time was probably owing to frequent handling and working of the leather; but I am confident, and know it from four years experience, that in the ordinary course of business, and in a common tan-yard, the tanner may have at least four months out of twelve, produce better leather, and find his bark go much farther than in the old way of tanning.

What was Macbride's new process? For butts and calf skins it was simply "that lime-water extracts the virtues of oak bark more completely than plain water."⁴⁹

⁴⁹ MACBRIDE, vol. 68, p. 120.

It is this lime-water which is now to be used in making your ooze, instead of plain common water; and this is all the difference between the old and the new method of tanning. . . . Every thing that relates to the cleaning, liming, fleshing, &c. is to be conducted precisely as in the old or common method of tanning; and the goods are to be worked in the handlers for the requisite time, and then laid away in the vatts, with layers and headings of bark, just as you now practice.

For sole leather, Macbride recommended altering the process of steeping or raising which swelled the pores of the hide. Previously this had been done by immersion in sour liquors of rye or other grain or milk of lime. To improve the steeping process, Macbride suggested that tanners "imitate the bleachers of linen who make use of a sour prepared by diluting the strong spirit of vitriol (H_2SO_4) . . . with a sufficient quantity of plain water" in the strength of one wine pint of acid to fifty gallons of water.⁵⁰ The hides remained in the sour until sufficiently raised, and then were put "directly into the ooze." Tanning continued as usual after this step, which hastened penetration of the hide by the ooze. Macbride wrote further of his new method:

Though it is possible to tan small parcels of leather . . . by the use of lime-water ooze, in a fourth part of the time which is required, if only common ooze be made use of; yet the business of a large tan-yard cannot be carried on with so much expedition; but even in large works, and in the common course of business, sole-leather can be completely tanned and finished, in, from eleven to fifteen months, according to the different weights and thickness of the hides. Butts in, from eight to twelve months and calf-skins in from six to twelve weeks; in general, the tanner may save at least one third of the time that has hitherto been required.⁵¹

A contribution equally as significant as Macbride's was made in 1794 by Armand Seguin who succeeded not only in speeding but also explaining "the combination of tannin with the gelatin and fibrine of skins." He speeded the tanning process by placing the hides in tannin of "a liquid and concentrated form." Seguin, the friend and colleague of Lavoisier, made "known the distinction between gallic acid and tannin, and the property which the latter possesses of combining with various animal substances, especially gelatins, forming with it the unalterable basis of leather."⁵²

Seguin's method of proceeding was described in detail by Julia de Fontenelle and Malepeyre in their volume on *The Arts of Tanning, Currying and Leather Dressing*. Campbell Morfit edited

⁵⁰ Ibid., pp. 125, 126.

⁵¹ Ibid., pp. 127, 128.

⁵² Morfit, pp. 211, 243. See also McKie, *Antoine Lavoisier* (New York, 1952), p. 146.

and translated this in 1852 in Philadelphia and the method which was to be so important for that time is here reprinted:

Seguin's Process, 1794

Seguin's mode of proceeding was as follows: His preliminary processes were the same as those of others, excepting, according to Dessables, that he directed the skins, after soaking and fleshing, to be rinsed in running water, so that all parts of them should be exposed to contact with it. He first deprived them of hair by means of lime, and then deposited them in tan-juice, with which was mixed one-five hundredth, and sometimes one-thousandth part of sulphuric acid. For *raising* the hides, he first used a vat lined with a cement containing a little lime, and filled with water acidulated with one-fifteen hundredth part of sulphuric acid; but this did not answer the intended purpose, as the acid, instead of mixing with the water, combined with the lime. He therefore substituted wooden tubs for vats, filled them with water charged with one fifteen hundredth of concentrated sulphuric acid, which was gradually increased to one-thousandth part, and by this arrangement succeeded, according to the report made by him to the committee of public welfare, in *raising* hides in forty-eight hours. He asserted, however, that this operation of *raising* was not essential, and that he procured excellent leather from skins which had not been submitted to the treatment.

He did not stratify the skins in tan-vats, but placed them in vats filled with "ooze." For procuring this solution, a number of tubs were placed in a row, and filled with ground tan. A certain amount of water was then emptied into each tub, and filtering through the tan, dissolved out its soluble particles, and descending, ran into receiving vessels beneath. The liquid from the first vat was then thrown into the second one, and so on through the range, until it became saturated. As a considerable quantity of available material still remained in the tubs, they were affused with fresh water, which by a process of displacement, continued extracting the soluble matters until the tan was entirely exhausted.

Seguin placed the skins, after being taken from the acid bath, in a very weak infusion of tan, and there allowed them to remain only an hour or two for the purpose of giving color to the hair sides. They were then taken out and immersed in a stronger solution, and again and again deposited in infusions, increasing each time in strength until the tanning was entirely completed.

Oak Tanning—A patent was taken out in London, in the year 1804, for a tanning process, which is founded upon the principles established by Seguin. The oak bark is boiled for four hours, in a copper boiler, and when the tan is perfectly exhausted, the decoction is allowed to flow off through tubes into the vats, where it is cooled. The skins are deposited in this after being soaked and pressed, and if they exhaust the liquor before the close of the process, a fresh decoction is substituted. If it is desired to have the hair side whiter than ordinary, tan is mixed with the liquor. By this means a great amount of tannin is concentrated in a small quantity of material, and much less labor is required than in common; ten or twelve days producing as great an effect as eight or nine months of exposure by the old method. It is believed, however, that the skins are not thoroughly tanned

by it, and that the leather is of deficient quality. The great quantity of tannin presented to the skins, tans their surfaces rapidly, and prevents the entrance of the liquid into the interior.

The patentees use, besides the ground oak-bark, the chips and sawdust of the wood, and ordinary furze, and recommend the employment of young shoots, the roots, and superfluous branches of the oak, by the use of which they say that they procure a stronger decoction than that from the bark of the trunk which contains a thick matter incapable of being separated.

In 1819, additional improvements were introduced. The trunks, roots, branches, and leaves of oak being asserted to contain enough tannin to warrant their employment in tanning, were reduced to the state of chips or coarse powder, boiled in water, and used in the following manner:

For the tanning of calf or other light skins, one hundred pounds of the middle parts or branches of the oak in chips, is boiled in a copper boiler, with fifty-two gallons of water until the latter is reduced to thirty-nine gallons. This liquid is decanted, and upon the residue, is poured a second quantity of thirty-nine gallons of water, which is boiled away to twenty-one gallons. This decoction is set aside and serves for the first bath of the calf-skins after they have been cleaned upon the horse, while the first liquor is used for the second bath.

To tan common skins, a hundred pounds of the middle parts or branches of oak in chips, seventy-five pounds of fresh coarse tan, and twenty-seven and a half pounds of the root, are boiled in sixty-six gallons of water, until the latter is reduced to two-thirds. The decoction is then decanted off from the partially exhausted matter, and fifty-two gallons more of water are poured upon it and boiled until reduced to one-half. This liquid is used as the first bath for the skins, and the one previously obtained as the second; and when they have been exposed long enough to both, enough fresh bark or tan-liquor to complete the tanning is added. This method seems to be very incomplete throughout and the inventors have failed to make known the proportions of tanning material to the number of skins, and the length of time required for the completion of the processes.

In these tannings, the skins were not thrown promiscuously into the vats, but were suspended vertically at intervals of about an inch from each other, so as to prevent the surfaces from touching; and to facilitate this mode of suspension, they directed the heads of the skins to be cut off, and bands on each side having attached to them the legs and parts of the bellies, to be removed. The bodies of the skins were to be divided into pieces proportioned to the depth of the vats, which pieces were to be suspended in them, while the other parts, being of less value, were thrown together into the bottom.

In tanning skins for uppers, after washing and fleshing them, Seguin directs that they be freed from hair by soaking in clear lime-water, and then, without being *raised*, tanned in weak solutions of bark made into a kind of ooze. The strength of these solutions was to be gradually increased, but not to the point of complete saturation, as in the case of strong hides. He succeeded in this way in tanning leather for uppers in three or four days.

The method of tanning proposed by Seguin are rapid in the extreme, but they have not been generally adopted, since the leather made by them is inferior to that by the old process, and is less merchantable. It is possible,

that if public business had not drawn away the attention of Seguin from his investigations, he might have succeeded in effecting a complete revolution in the art of tanning. As it is, he has numerous followers, many of whom, in England and elsewhere, have patented and used variations of his process; but the essential objection to this mode of operating still attaches to all of them, namely, that the combination of tannin with the gelatine and fibrine upon the surfaces of the skins, takes place so rapidly, that the superficial layer of leather thus formed prevents the passage of the liquor into the interior of the hide, and consequently its perfect tanning.

By Seguin's method the hide was first washed and thoroughly cleaned, then the hair was removed by means of lime. After cleaning, calf and other light skins were put directly in tan vats containing a solution of bark, water, and one five-hundredths part of sulphuric acid. Where others had stratified their vats with alternate layers of bark and hides, Seguin employed an immersion technique. By having a series of connecting receptacles, the acid tan juice was recirculated through an entire range of vats. If, in the case of sole leather, raising or swelling was deemed necessary, Seguin, as had Macbride, recommended baths of sulphuric acid and water. This removed the hair in 48 hours where previously months had been required. For the lighter variety of hides, raising usually was not required. By his process Seguin could produce finished leather in three or four days.⁵³ At a time when French armies were in dire need of leather for shoes, boots, and saddles, this accelerated technique won Seguin the praises of his government.⁵⁴ But in the speed of the reaction quality was sacrificed, because only a superficial layer of leather was formed during the short time that the hides were in the tan vats.

Sir Humphry Davy, in a series of lectures begun in 1802 on the "Chemistry of the Arts,"⁵⁵ not only defined chemically the transition of raw hide to leather, but also revealed the cardinal principle in the economics of tanning: to make a profit, tanners had to give hides the greatest possible weight in the shortest possible time.⁵⁶ Davy viewed tanning as an extremely simple chemical process "of great importance to society" with the proper procedures already (1802) reduced to scientific principles; but, alas, "the improvements, resulting from new investigations have not been uniformly adopted by manufacturers." This was not because of miscalculation or

⁵³ Morfit, pp. 243-248.

⁵⁴ McCloy, *French Inventions of the Eighteenth Century*, pp. 82, 82 (fn. 33).

⁵⁵ *Collected Works of Sir Humphry Davy*, edit. John Davy, vol. 2, pp. 416-420.

⁵⁶ Clow, *The Chemical Industries*, p. 496.

error by the "chemical philosophers" who propounded the new concepts, but rather it appeared to be "the difficulty occurring in inducing workmen to form new habits, to a want of certain explanations of the minutia of the operations and perhaps in some measure to the common prejudice against novelties."⁵⁷

The chemistry of the tanning process as it was understood in the early 1800's is described in detail in Thomas Martin's *Circle of the Mechanical Arts*, London, 1813. This description, which discusses Seguin's process in the light of Davy's discoveries, is reproduced in the appendix (p. 75).

By 1812, Tench Coxe and other American lobbyists for expanded manufacturers echoed Davy's remarks as well as those of native innovators. Although "every description or variety of leather" was already made, still "much utility and profit" could be gained "from superior tanning, coloring, dressing, workmanship, fancy, taste and economy, in the whole range of the operations of the leather manufacture."⁵⁸ But too often Americans took fine "bark, lime, and water-sites" and other resources for granted; however, Coxe believed, even with the waste of these natural riches, "were chemistry in particular, and the general science" applied to domestic production, the excellence and quality of American leather goods would be assured. Yet some dissented and cautioned care in the employment of faster methods. In his *Brief Retrospect of the Eighteenth Century*, Samuel Miller agreed that "pressing necessity" might demand speed but noted that the results were frequently expensive and in fact "injurious to the leather."⁵⁹

Whether a reaction to novelty or not, the chemistry of tanning simply failed to excite enthusiasm. In 1851 at London's Crystal Palace, while the world marveled at such products of industrial ingenuity as Colt's revolver and McCormack's reaper, the jurors surveyed the exhibitors of leather and reported that "though numerous experiments have been tried, and many patents granted for new processes, there has been no decided improvement, no marked progress, to show that better results have been obtained than by the old methods of tanning."⁶⁰

⁵⁷ DAVY, op. cit., vol. 2, p. 317.

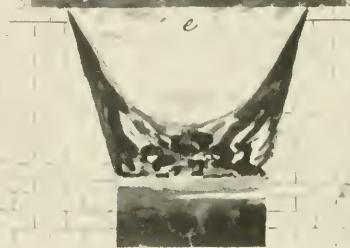
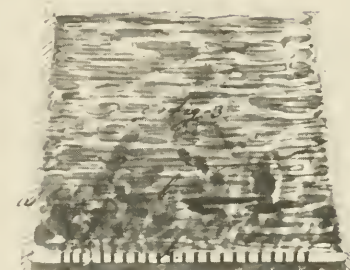
⁵⁸ COXE, *Statement of the Arts and Manufactures of the United States of America for the Year 1810*, part 2, pp. xxxv, xxxvi.

⁵⁹ Vol. 1, pp. 399, 542.

⁶⁰ GREAT EXHIBITION . . . 1851, *Reports by the Juries* . . . , p. 388. In the preface to the American section in the *Official Descriptive and Illustrated Catalogue* (London, 1851), vol. 1, pp. 1431, 1432, no mention is made of domestic leather production.

William Edwards
Tanning

Patented Dec 14 1864



Substance of the patent is a process of tanning
by which the leather is made soft and pliable
and is not liable to become dry and brittle
as is the case with the ordinary process.

Corrected by W. M. Allen

Patented Dec 14 1864
The object of the
invention is to produce a leather which
is not liable to become dry and brittle
as is the case with the ordinary process.

Figure 13.—William Edwards' Patent, 1812. Some American tanners kept abreast of the latest European improvements.

Among the numerous experiments between the year of the Davy lectures and the world's first great fair were a considerable number suggested by Americans, and it should be no surprise that most of these merely rephrased procedures previously tried and published abroad. For example, note the patent claim of William Edwards (see fig. 13), who, seeking to improve the tanning of sole leather, in 1812 advocated the application of heat to the tanning solution. To European tanners, the Edwards formula had been familiar practice since at least the 1790's. And Fessenden, in publishing Anthony Fay's English patent in 1808, anticipated Edwards' efforts "to entirely extract the tanning principle from the bark" thereby to produce "a saving of bark and time in the process."⁶¹

Samuel Parker, more original than Edwards, hopefully patented (see fig. 14), besides a splitting machine, two Oliver Evans-like systems in 1808 to reduce the work in both tanning and currying⁶² by means of machines designed to do "every part of the business at once." Parker, like so many manufacturers, foreign and domestic, sought with equally poor success to save at once time, labor, and ingredients. Certainly for Parker to have curried leather mechanically by "extending, smoothing, consolidating, splitting, scouring, cutting, cramping, oiling, stuffing, stamping, or printing, blackening, sizing, sticking, striping, polishing, glazing or finishing"⁶³ would have been no less a technical contribution than Evans' automatic flour mill, Blanchard's profile lathe, or Whitney's system of manufacture based on a process of interchangeable parts.

Less fanciful than Parker's patent were those for leather splitting devices conceived, but sparsely employed, by Americans before 1850. Seth Boyden, the father of one of the country's leading early machinist-inventors, patented in 1809 the first workable splitting machine, and quite naturally he knew it would be "highly useful to Tanners and Curriers."⁶⁴ Boyden pointed

⁶¹ For Edwards' patent see *Restored Patents*, vol. 3 (1811-1816), p. 171, in the National Archives, Washington, D.C. In addition see FESSENDEN, *Register of Arts*, pp. 15-18; and BISHOP, vol. 1, p. 453. For a list of tanning patents issued through 1883 see Depew, ed., *1795-1895. One Hundred Years of American Commerce*, vol. 2, p. 496.

⁶² *Restored Patents*, vol. 2 (1804-1810), pp. 233-237, 241-244. In addition see BRYANT, *Shoe and Leather Trade of the Last One Hundred Years*, p. 127.

⁶³ *Restored Patents*, vol. 2, p. 474.

⁶⁴ *Restored Patents*, vol. 2, pp. 331-332. For additional material relating to the Boydens, see BISHOP, vol. 2, p. 311; the *American Machinist* (Feb. 13, 1886), vol. 9, pp. 2-3; and the *Dictionary of American Biography*, vol. 2, pp. 528-529.

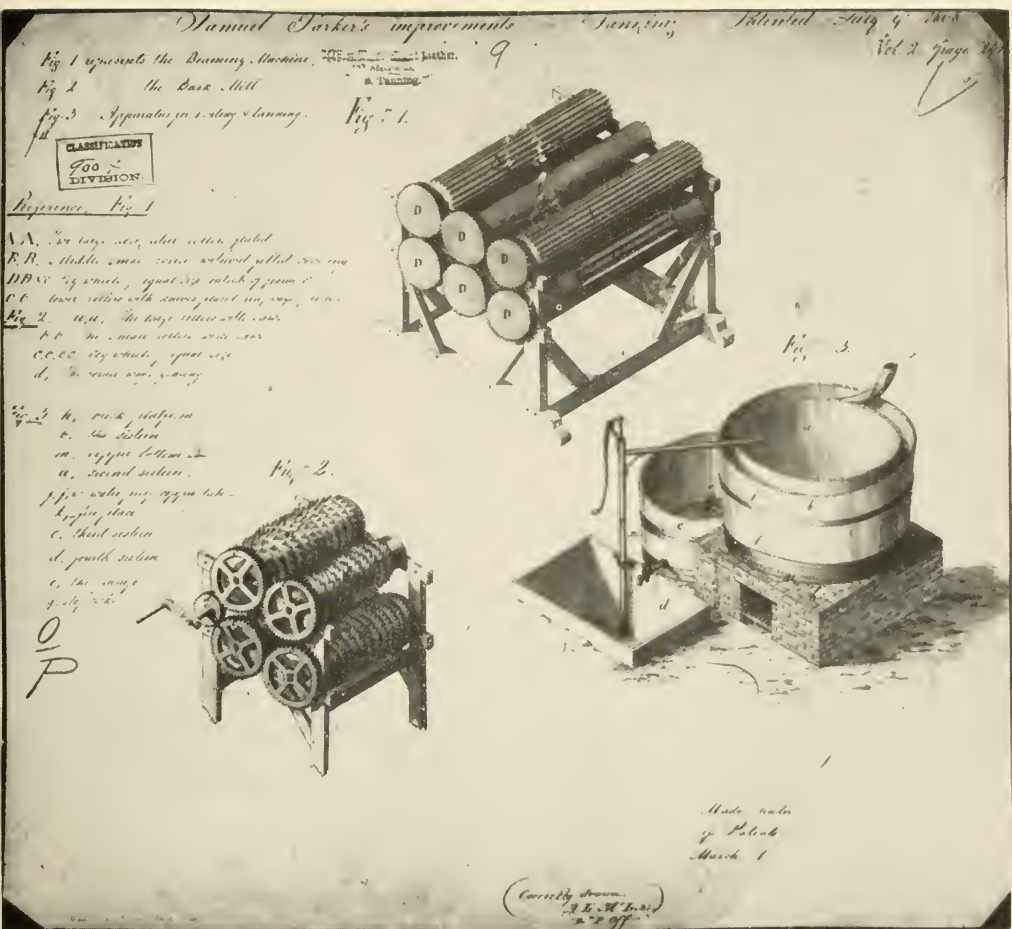


Figure 14.—Samuel Parker's Patent, 1808. Americans early in the nineteenth century patented machinery designed to speed the production of leather. Some, like Samuel Parker, hoped wishfully to mechanize the entire operation from raw hide to leather.

out that the advantage of such a machine, besides saving labor, was that it allowed a hide to be split fresh from the lime pits and thus to "be tanned sooner, with less bark and more thoroughly." The entire production of the so-called fancy leathers—for book binding, for boots, for chaise and carriage tops, and for trunks and hats—promised to increase. Now, wrote Boyden, "a man or a boy of eight or ten years of age will shave eight or ten" hides by machine "to one the usual way" (see fig. 15).

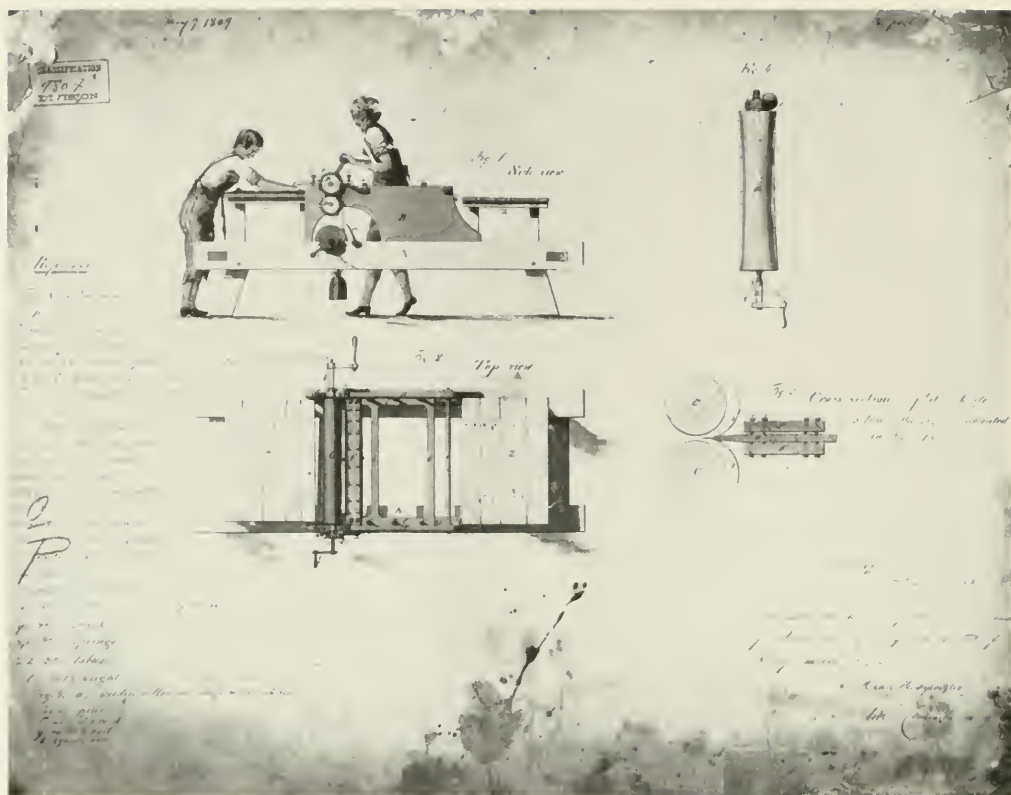


Figure 15.—Seth Boyden's Patent, 1809. Seth Boyden successfully attacked specific problems of the tanner—namely the practicality of splitting hides by machinery.

Ideas for the design of splitting equipment proliferated; and by 1831 Alpha Richardson had perfected the prototype that, before the century ended, became a standard item in many tanneries.⁶⁵ Although the splitting machine was used to make fine, showy, grained leather, the fundamental stimulus to its development proved to be not aesthetic but rather, as an early innovator, Phineas Dow, observed, “to make two skins out of one.”⁶⁶ At the Crystal Palace the same jurors who had seen little progress in tanning processes during the previous fifty years (1800 to 1850) found the leather industry “very much” improved by “mechanical

⁶⁵ DAVIS, *The Manufacture of Leather*, p. 369.

⁶⁶ Restored Patents, vol. 2, p. 474.

means,” particularly by the invention of “very ingenious machinery for splitting hides and skins.”⁶⁷ However, this was the only aspect of the craft’s mechanization that warranted comment, and a quarter of a century later at Philadelphia’s Centennial Exhibition in 1876, the leather industry exhibited “little machinery” that was new; and what was shown was classed “so deficient” in labor-saving advantages that none could “be recommended for general use.”⁶⁸ Nevertheless, ideas, sometimes bizarre, continued to be patented by American tanners, and some were eventually adapted to use. Josiah Bonney, for example, in 1834 suggested the use of the ubiquitous waterwheel, both as an agitator and as a washing machine⁶⁹ (see fig. 16); by the 1850’s more reasonable, workable versions of his idea could be seen turning in some of the country’s largest tanneries.⁷⁰ Yet despite minor advances, tanning persisted much as Tench Coxe described it in 1812: “generally a manufacture by hand, and not by machinery,”⁷¹ an empirical craft, not a chemical industry.

⁶⁷ GREAT EXHIBITION . . . 1851, *Reports by the Juries* . . . , p. 388.

⁶⁸ Francis A. Walker, ed., United States Centennial Commission International Exhibition, 1876, *Reports and Awards*, vol. 10, Group 12, p. 13.

⁶⁹ Restored Patents, vol. 18 (1834), pp. 483–484.

⁷⁰ KENNEDY, *The Art of Tanning Leather*, pp. 80, 120, 132; DAVIS, *Manufacture of Leather*, figs. 112 and 234.

⁷¹ *Statement of the Arts and Manufactures* . . . , part 1, p. xv.

149, Elder, Street, Leather,

11, Trunking Drums

Josiah Bonney

Brushing & Working Hides & Tanning
Leather.

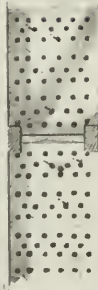
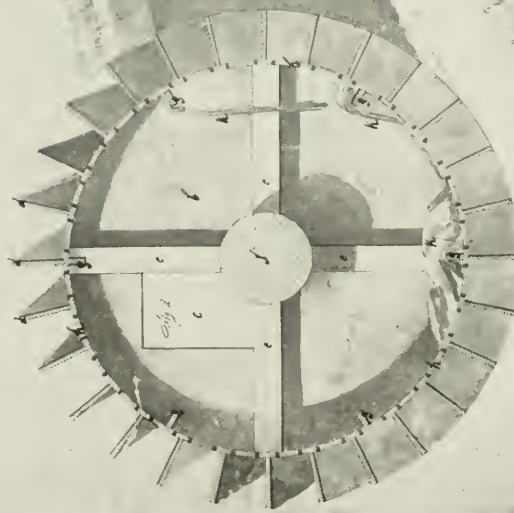


Fig. 3. Section of the wheel showing the turning & work holes &c &c



Section of the wheel

J. S. Clarkman, engr.

Pat. 14, 15, 16, 17, 18, 19, 20, 21, 22, 23, 24, 25, 26, 27, 28, 29, 30, 31, 32, 33, 34, 35, 36, 37, 38, 39, 40, 41, 42, 43, 44, 45, 46, 47, 48, 49, 50, 51, 52, 53, 54, 55, 56, 57, 58, 59, 60, 61, 62, 63, 64, 65, 66, 67, 68, 69, 70, 71, 72, 73, 74, 75, 76, 77, 78, 79, 80, 81, 82, 83, 84, 85, 86, 87, 88, 89, 90, 91, 92, 93, 94, 95, 96, 97, 98, 99, 100, 101, 102, 103, 104, 105, 106, 107, 108, 109, 110, 111, 112, 113, 114, 115, 116, 117, 118, 119, 120, 121, 122, 123, 124, 125, 126, 127, 128, 129, 130, 131, 132, 133, 134, 135, 136, 137, 138, 139, 140, 141, 142, 143, 144, 145, 146, 147, 148, 149, 150, 151, 152, 153, 154, 155, 156, 157, 158, 159, 160, 161, 162, 163, 164, 165, 166, 167, 168, 169, 170, 171, 172, 173, 174, 175, 176, 177, 178, 179, 180, 181, 182, 183, 184, 185, 186, 187, 188, 189, 190, 191, 192, 193, 194, 195, 196, 197, 198, 199, 200, 201, 202, 203, 204, 205, 206, 207, 208, 209, 210, 211, 212, 213, 214, 215, 216, 217, 218, 219, 220, 221, 222, 223, 224, 225, 226, 227, 228, 229, 230, 231, 232, 233, 234, 235, 236, 237, 238, 239, 240, 241, 242, 243, 244, 245, 246, 247, 248, 249, 250, 251, 252, 253, 254, 255, 256, 257, 258, 259, 260, 261, 262, 263, 264, 265, 266, 267, 268, 269, 270, 271, 272, 273, 274, 275, 276, 277, 278, 279, 280, 281, 282, 283, 284, 285, 286, 287, 288, 289, 290, 291, 292, 293, 294, 295, 296, 297, 298, 299, 300, 301, 302, 303, 304, 305, 306, 307, 308, 309, 310, 311, 312, 313, 314, 315, 316, 317, 318, 319, 320, 321, 322, 323, 324, 325, 326, 327, 328, 329, 330, 331, 332, 333, 334, 335, 336, 337, 338, 339, 340, 341, 342, 343, 344, 345, 346, 347, 348, 349, 350, 351, 352, 353, 354, 355, 356, 357, 358, 359, 360, 361, 362, 363, 364, 365, 366, 367, 368, 369, 370, 371, 372, 373, 374, 375, 376, 377, 378, 379, 380, 381, 382, 383, 384, 385, 386, 387, 388, 389, 390, 391, 392, 393, 394, 395, 396, 397, 398, 399, 400, 401, 402, 403, 404, 405, 406, 407, 408, 409, 410, 411, 412, 413, 414, 415, 416, 417, 418, 419, 420, 421, 422, 423, 424, 425, 426, 427, 428, 429, 430, 431, 432, 433, 434, 435, 436, 437, 438, 439, 440, 441, 442, 443, 444, 445, 446, 447, 448, 449, 450, 451, 452, 453, 454, 455, 456, 457, 458, 459, 460, 461, 462, 463, 464, 465, 466, 467, 468, 469, 470, 471, 472, 473, 474, 475, 476, 477, 478, 479, 480, 481, 482, 483, 484, 485, 486, 487, 488, 489, 490, 491, 492, 493, 494, 495, 496, 497, 498, 499, 500, 501, 502, 503, 504, 505, 506, 507, 508, 509, 510, 511, 512, 513, 514, 515, 516, 517, 518, 519, 520, 521, 522, 523, 524, 525, 526, 527, 528, 529, 530, 531, 532, 533, 534, 535, 536, 537, 538, 539, 540, 541, 542, 543, 544, 545, 546, 547, 548, 549, 550, 551, 552, 553, 554, 555, 556, 557, 558, 559, 560, 561, 562, 563, 564, 565, 566, 567, 568, 569, 570, 571, 572, 573, 574, 575, 576, 577, 578, 579, 580, 581, 582, 583, 584, 585, 586, 587, 588, 589, 590, 591, 592, 593, 594, 595, 596, 597, 598, 599, 600, 601, 602, 603, 604, 605, 606, 607, 608, 609, 610, 611, 612, 613, 614, 615, 616, 617, 618, 619, 620, 621, 622, 623, 624, 625, 626, 627, 628, 629, 630, 631, 632, 633, 634, 635, 636, 637, 638, 639, 640, 641, 642, 643, 644, 645, 646, 647, 648, 649, 650, 651, 652, 653, 654, 655, 656, 657, 658, 659, 660, 661, 662, 663, 664, 665, 666, 667, 668, 669, 670, 671, 672, 673, 674, 675, 676, 677, 678, 679, 680, 681, 682, 683, 684, 685, 686, 687, 688, 689, 690, 691, 692, 693, 694, 695, 696, 697, 698, 699, 700, 701, 702, 703, 704, 705, 706, 707, 708, 709, 710, 711, 712, 713, 714, 715, 716, 717, 718, 719, 720, 721, 722, 723, 724, 725, 726, 727, 728, 729, 730, 731, 732, 733, 734, 735, 736, 737, 738, 739, 740, 741, 742, 743, 744, 745, 746, 747, 748, 749, 750, 751, 752, 753, 754, 755, 756, 757, 758, 759, 760, 761, 762, 763, 764, 765, 766, 767, 768, 769, 770, 771, 772, 773, 774, 775, 776, 777, 778, 779, 780, 781, 782, 783, 784, 785, 786, 787, 788, 789, 790, 791, 792, 793, 794, 795, 796, 797, 798, 799, 800, 801, 802, 803, 804, 805, 806, 807, 808, 809, 810, 811, 812, 813, 814, 815, 816, 817, 818, 819, 820, 821, 822, 823, 824, 825, 826, 827, 828, 829, 830, 831, 832, 833, 834, 835, 836, 837, 838, 839, 840, 841, 842, 843, 844, 845, 846, 847, 848, 849, 850, 851, 852, 853, 854, 855, 856, 857, 858, 859, 860, 861, 862, 863, 864, 865, 866, 867, 868, 869, 870, 871, 872, 873, 874, 875, 876, 877, 878, 879, 880, 881, 882, 883, 884, 885, 886, 887, 888, 889, 890, 891, 892, 893, 894, 895, 896, 897, 898, 899, 900, 901, 902, 903, 904, 905, 906, 907, 908, 909, 910, 911, 912, 913, 914, 915, 916, 917, 918, 919, 920, 921, 922, 923, 924, 925, 926, 927, 928, 929, 930, 931, 932, 933, 934, 935, 936, 937, 938, 939, 940, 941, 942, 943, 944, 945, 946, 947, 948, 949, 950, 951, 952, 953, 954, 955, 956, 957, 958, 959, 960, 961, 962, 963, 964, 965, 966, 967, 968, 969, 970, 971, 972, 973, 974, 975, 976, 977, 978, 979, 980, 981, 982, 983, 984, 985, 986, 987, 988, 989, 990, 991, 992, 993, 994, 995, 996, 997, 998, 999, 1000

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Patent Office in August 1881

Shall under the direction of the Commissioner

of Patent in conformity with Act of March 1878

Approved March 1881

One witness of Patent.

Figure 16.—Josiah Bonney's Patent, 1834. Josiah Bonney's idea of the waterwheel as an agitator and washer became in modified form, after 1850, standard equipment in the larger leather factories.

Chapter III

Delaware Tanneries

"The Tanning Trade . . . may be here managed to good advantage."—*Thomas Budd, 1685*

Examined in some detail in a single area, such as Delaware, the techniques and business practices of an entire industry are revealed. What confronted a tanner in Delaware also faced his counterpart in New England, New York, Pennsylvania, and, to some degree, in the South. In Delaware, tanners had long found the perquisites of their trade convenient and the markets for their product widespread and demanding. In fact, quercitron or black oak bark used both in tanning and the dye trades had been a Wilmington export well before 1775.⁷² Beyond the essential raw materials, the tanning industry required a steady supply of pure water (Diderot considered water to be one of the essential tools of the tanner, but not necessarily for power),⁷³ and in Delaware the nearness of clear water, of oak bark, and of good pastureland for cattle contributed to the success of the industry.⁷⁴

Joshua Gilpin reported in 1832 that leather manufacture in Delaware was "very old" and largely "founded on its own materials."⁷⁵ Since the time of first settlement in 1638 a succession of Swedish governors had cited the need for tanners, leather dressers, and cordwainers.⁷⁶ Hides were abundant, and before the arrival of the English, the Swedes wore waistcoats and breeches of skins they had tanned, while some of them, according to Peter Kalm, "had learned to prepare leather, and make shoes with heels."⁷⁷

As early as 1683, Penn had noticed that there was "plenty of Bark" for tanning; and a year later John Grubb obtained a 4-acre tract in New Castle County for a tanyard,⁷⁸ in a region where "*Hides* being plenty, and had at moderated Prices, and Bark to

⁷² BISHOP, vol. 1, p. 461.

⁷³ See p. 1 of "Tanneur" in vol. 9 of *L'Encyclopédie . . . Recueil des Planches . . .*

⁷⁴ MUNROE, *Federalist Delaware*, p. 128.

⁷⁵ McLane Report, vol. 2, p. 778.

⁷⁶ Myers, ed., *Narratives of Early Pennsylvania . . .*, pp. 125, 126, 140, 142, 148.

⁷⁷ Benson, ed., *The America of 1750; Peter Kalm's Travels in North America*, vol. 1, p. 272. See also JOHNSON, *The Swedish Settlements on the Delaware*, and ACRELIUS, "History of New Sweden," *Memoirs of the Historical Society of Pennsylvania*, (1874), vol. 11.

⁷⁸ New Castle County Deeds.

be had for only the charge getting it," a tanning business could be "managed to good advantage."⁷⁹ Delaware's other two counties, Kent and Sussex, were described as "The chiefest and most commodious places . . . for Breeding and Improving all sorts of Cattle."⁸⁰ The plentiful combination of hides and bark caused tanneries and bark mills to be built in 1689 at Milford, in 1693 at Angola Neck in Indian River Hundred, and, soon afterwards, in Georgetown, where a number of small tanneries operated.⁸¹

Tanners came to Wilmington at an early date. Francis Robinson, one of the town's first Quaker residents, prepared buckskin and chamois leather in the 1730's, the decade in which the town was chartered. In the 1740's, Joseph West built a tannery,⁸² and as early as 1742, while others were busily building gristmills, the Starr tannery began operation.⁸³ In the 1750's, with the town's population and trade fast increasing, the Philadelphia newspaper advertised a lot for sale "with water running across it fit to plant a tanyard in."⁸⁴ In the same years, the *Pennsylvania Gazette* again described a tannery owned by David Ferris as being particularly commodious and "conveniently situated with suitable Buildings and Utensils for carrying on the Business, and a Spring of good water, which is conveyed in Spouts to all the Parts of the yard."⁸⁵ Apparently the advantages of good water were as clear to Delaware tanners as to Diderot's encyclopedists.

John Lewden owned a tanyard very near Wilmington in 1774 and, in 1778, Isaac Starr "became acquainted with the tanning business." Starr, a resident of Wilmington, recollected that just before the Revolution—

Although we abounded in every requisite material for making leather, yet very large quantities were imported from England; no power existed here to reject it and foster our own manufactures; a consequence was that when war came the country was bare of leather and suffered greatly.⁸⁶

⁷⁹ BUDD, *Good Order Established in Pennsylvania and New Jersey*, pp. 40-41.

⁸⁰ GABRIEL THOMAS, "An Historical and Geographical Account," p. 323, in Myers, ed., *Narratives of Early Pennsylvania*

⁸¹ CONRAD, *History of the State of Delaware*, vol. 2, pp. 723, 730.

⁸² SCHARF, *History of Delaware, 1609-1888*, vol. 2, pp. 650-651.

⁸³ McLane Report, vol. 2, p. 756.

⁸⁴ *Pennsylvania Gazette*, July 4, 1754; the lot was owned by Joseph Hewes. Similarly Job Jacob's advertisement in the *Gazette*, July 13, 1749.

⁸⁵ *Pennsylvania Gazette*, September 7, 1758. According to the *Delaware Gazette* of September 17, 1791, Ferris' tanning business comprised 18 vats, 6 handlers, 3 lime vats, a well house and a currying shop.

⁸⁶ McLane Report, vol. 2, p. 749. References to Isaac H. Starr, tanner, may be found in the Sharpley Account Book (Business records, Historical Society of Delaware, Wilmington), pp. 4-5.

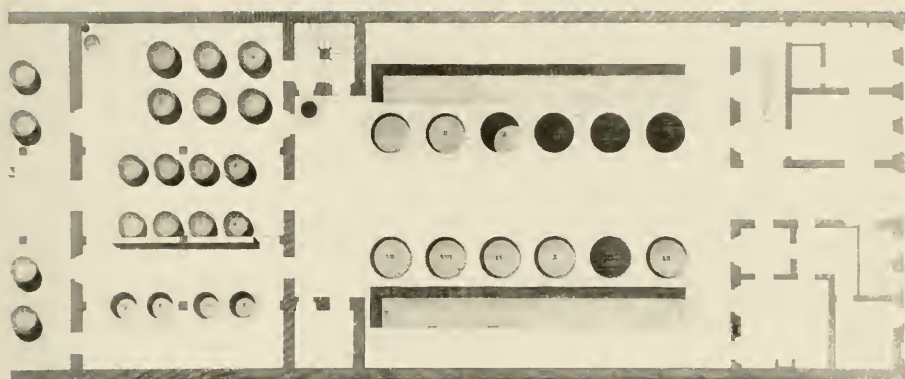


Figure 17.—The Plan of a Tannery. Diderot, 1771. Diderot's ground plan of a tannery indicates the rationalization of the several stages of leather manufacture that proceeded from washing and fleshing on the left to liming and bating, thence to the tan pits in the open yard, and finally to the drying lofts at the far right. Thomas Smith's tannery as described in the *Delaware Gazette* in 1817 approximates Diderot's plan.

Starr continued his recollections of the years preceding and following the Revolution and, although doctrinaire, they are representative of the viewpoint of the state's manufacturing interests:

When peace came, things returned nearly to the old condition; a free trade for the introduction of English manufactures; general paralization followed . . . ; but since sufficient protection for leather has been given by our laws, the manufactured article has become abundant.

By 1791, out of a population of some 5000, there were forty-two "Shoe and Boot Makers" in Wilmington.⁸⁷ By 1804, a listing of the industries of Christiana Hundred showed five tanners—John Smith, Jonas Starr, Thomas Meredith, William Seal, and Joseph Wilkinson—in business supplying leather to craftsmen in Wilmington.⁸⁸ In a community dotted with mills and budding industries,

⁸⁷ "Return of Manufactures, Tradesmen &c in Wilmington, Delaware and its Vicinity . . . November 28th 1791," in Alexander Hamilton MSS., Library of Congress.

⁸⁸ SCHARF, vol. 2, p. 885.

Joseph Scott noted particularly the manufacture of "leather, shoes, boots and saddles."⁸⁹

There were ten tanneries reported in and around Wilmington in 1810, valued at \$56,405.⁹⁰ By 1814, the year in which H. Niles thought the place "likely to become one of the most important manufacturing towns in the United States,"⁹¹ Isaac Poulson, George Poulson, William Smith, and Davis Walker were making shoes in nearby Brandywine Village; while across the Brandywine in Wilmington, thirteen tanners and curriers plied their trade.⁹² One year later, the firm of "A. Cardon & Co." began business on the banks of the Brandywine—an operation that will be examined more carefully in the next chapter.

In 1817, one of the oldest Wilmington tanneries, Thomas Smith's (see fig. 17), was described in the *Delaware Gazette* with more than usual detail.

A Lot of ground on the corner of West and Second streets . . . on which is erected one large stone bark house, 60 feet by 31 feet, with a good cellar underneath; one handling house and drying loft, 40 feet by 15 feet; one beam house and drying loft, 20 feet by 15 feet; one mill house, 30 feet square; one stable, 30 feet by 12 feet; one bark shed, 67 feet long, with a pump; one stone lime house; one brick building, occupied as a counting house, 14 feet square; with 86 holes, which consists of 2 pools, 3 limes, 6 bates, 12 handlers, 6 latches, and 57 layaway vats, all in complete order. The pools, limes and bates draw off at the bottom. The whole lot is enclosed with a good stone and board fence.

Toward the end the writer's enthusiasm mounted, and a routine effort to sell a property became a hearty endorsement of local commerce and its potential.

A more particular description of this well known property cannot be necessary; as a tannery, its local advantages are excelled by none if equalled by any in the state. Health, an overflowing fountain of the finest water, a ready supply of raw materials, a daily intercourse with the city of Phila-

⁸⁹ *Geographical Description of the States of Maryland and Delaware*, p. 171.

⁹⁰ *American State Papers* . . . , Finance, vol. 2, p. 764.

⁹¹ *Niles' Weekly Register* (1814), vol. 6, p. 277.

⁹² *Directory and Register for the Year 1814 . . . of the Borough of Wilmington and Brandywine* lists tanners and curriers in Wilmington as follows: William Brown, 22 E. High St.; William Chandler, 15 Shipley St.; Thomas Lock, Orange between 2nd and 3rd Sts.; Thomas Ring, 39 King St.; William and Caleb Seal, west corner of Hanover St.; Thomas Smith, W. 2nd above Tatnall St.; Robert Squibb, 24 W. High St.; Thomas Stanton, W. High between Tatnall and West Sts.; Joshua Starr, West between 2nd and 3rd Sts.; Trip and Bonsall, corner of Tatnall and 2nd Sts.; Benjamin Webb, West between Hanover and Queen Sts.; Robert Wilkinson & Co., 40 W. High St.; and David and Carson Wilson, W. 3rd near Tatnall St.

delphia, and situated in a part of town where property is fast increasing in value, are among the advantages that may be mentioned.⁹³

Wilmington tanners by 1821 included Jackson and Webb, Evans Lewis, B. R. Webb, and Isaac Starr.⁹⁴ Starr's tannery, dating from the 1740's, a family business, was the oldest of the four. Its longevity is surprising since Isaac Starr revealed that "not having any joint concern or any borrowed capital, I have not been under the necessity of keeping any accounts of purchases or sales; have no balance sheet, nor any means to ascertain profits or loss, but by experience."⁹⁵ Webb was more precise in his practices, indicating that he tanned "from 1500 to 2000 hides per year," employed six boys, had seventy-two vats, and "manufactured from 20 to 30 tun of quercitron Bark at which from one to two hands are employed."⁹⁶ Evans Lewis's principal product was sole leather. He tanned Spanish hides in an establishment that employed "Four men and three boys," had "one cast iron bark mill always in operation," and a capital investment of "From 15 to 20,000 Dollars."⁹⁷ Dry or Spanish hides were used for many purposes: "viz: uppers for shoes and boots, Harnesses, and the construction of carriages of pleasure, mail bags, saddlery, engine hose, rigging and for all purposes where flexibility is required, [and] also for sole leather."⁹⁸ The demand for sole leather seemed to Lewis to be "increasing, though the price [was] low and profits light."⁹⁹

When tanners began to experience a shortage of bark in the 1820's, some closed and others reduced their output. But in New Castle County nine tanners, curriers, and bark manufacturers (in aggregate) still employed 37 men; they had \$33,000 invested in real estate, waterpower, and machinery; they paid \$50,396 for raw materials annually; and they sold \$60,800 worth of leather and bark per year.¹⁰⁰

Isaac Jackson, another Wilmington tanner, provided a full statement of one year's business in the following "Account of Stock Purchased in the year ending Twelfth Month 31, 1831."¹⁰¹

⁹³ April 16, 1817. In the Delaware State Archives, Dover, Delaware, assessment list for Christiana Hundred, 1816, p. 192, Smith is assessed \$2916 for "one tan yard, tan house and other buildings occupied as a leather manufactory."

⁹⁴ Census Schedules, New Castle County, Delaware, 1820. National Archives.

⁹⁵ McLane Report, vol. 2, p. 748. ⁹⁶ B. R. Webb, in Census Schedule, March 28, 1821.

⁹⁷ Evans Lewis, in Census Schedule, April 20, 1821.

⁹⁸ Jackson and Webb, in Census Schedule, May, 1821.

⁹⁹ Evans Lewis, in Census Schedule, April 20, 1821.

¹⁰⁰ McLane Report, vol. 2, pp. 756-757. ¹⁰¹ *Ibid.*, p. 826.

600 sole leather hides	\$2,100
200 upper	500
600 calf skins	600
Amount of hides and skins in a raw state	3,200
90 cords Spanish oak bark at \$11	\$990
10 cords black oak, at \$6	60
Labor of two men and two boys, one year	650
Expense of keeping one horse for grinding bark	100
Rent of tanyard	75
Incidental expenses	75
	1,950
	5,150
One year's interest on \$5,000 capital	300
	5,450
The proceeds of the above stock when manufactured may be estimated at the present market prices, as follows:	
16,000 lbs. sole leather at 25 cents	4,000
200 upper leather hides, at \$4.50	900
600 calf skins, at \$20 per dozen	1,000
Sale of offal, viz horns, tails, hair, glue pieces	150
	6,050
Amount of raw materials and expenses brought down	5,450
Net proceeds	\$600

Of greater interest, however, are Jackson's remarks concerning the region's leather industry, since they serve as an excellent summary in concluding the survey of Wilmington's leather trade:

The amount of tanning business done in this place has been much diminished within fifteen or twenty years past; at the same time that it has been increasing in the adjacent country. This change it is believed, is principally owing to the high price of Spanish oak bark in the former which has generally been at eleven dollars a cord, for that brought in wagons, (which is very limited in quantity,) and from thirteen to fifteen dollars for that shipped from the lower parts of this peninsula. At the distances of twenty and thirty miles from this place, in the country bordering on the Susquehanna River, good Spanish oak bark is procured at five, six and seven dollars a cord; hence it will readily be seen that tanners located in that district, have an advantage of six or seven dollars a cord above those in this place, making a stock of 200 cords, annual saving of \$1,200 at least. It may be observed that they are subject to considerable expense in the transportation of hides to their establishments, and of the leather to market, which, for a stock of 1,000 heavy

Spanish hides, may be estimated at £200, which leaves a balance of 1,000 annually in favor of the country establishments, besides the comparative cheapness of current expenses of a family.

In ascribing the decline of the business in this place to the high price of bark, I may be thought in error, as it was equally high in former years, when more than double the amount of the present business was done; but at that time the prices of Spanish hides were lower, and the prices of leather 20 per cent higher. In 1817-18, best Spanish hides were from 14 to 16 per lb., and sole leather from 30 to 32 cents. At this time hides are from 16 to 18 cents, Spanish sole leather from 22 to 25 cents.¹⁰²

Tanyards and sites for tanyards offered for sale or rent, outside of Wilmington, were not uncommon even early in the eighteenth century. In the older and, at the time, flourishing town of New Castle, a "*Tan-House and Tan-Yard*" was to be "Sold or Let" in 1733, along with "*near Four Hundred Hides . . . [and] several Dozen of Skins . . . now a Tanning.*"¹⁰³ James Merrewether, the owner, considered renting the yard, but he wanted "Ready Money" for the Hides and Skins. Ten years later, what appears to be the same establishment was again advertised and still again in 1758, but by this time the prospects of trade in New Castle were diminishing in favor of Wilmington.¹⁰⁴ Elsewhere, Thomas Noxon of Noxontown had operated a tannery,¹⁰⁵ and in May of 1750 the *Gazette* advertised a property formerly owned by John McMechen and its advantage was direct contact with Pennsylvania's rich hinterland of Berks, Chester, and Lancaster Counties. McMechen's property adjoined Christiana Bridge in White Clay Creek Hundred and included a "good tanyard, bark-house, and bark mill," and all fronted upon the great road running from the bridge to "Nottingham and Conestogoe" in Pennsylvania.¹⁰⁶

At Newport, the birthplace of Oliver Evans, Lewis Stone operated a tannery that included "two bark mills" and ready access to wharf facilities.¹⁰⁷ Located in the center of town and complete with a currying shop, millhouse, and beamhouse, it was said in 1762 by Samuel Ashmead to be "perhaps the best Seat for the Tanning Business in the County," since hides could be obtained

¹⁰² Ibid., p. 827.

¹⁰³ *Pennsylvania Gazette*, March 22-29, 1733.

¹⁰⁴ Ibid., September 15, 1743, and June 29, 1758. In these years, ownership seems to have passed from Merrewether to Stephen Lewis to Zachariah Van Leuvenigh.

¹⁰⁵ Ibid., Nov. 28, 1745. Noxon's property included a brick malthouse and brewhouse as well as a tanyard.

¹⁰⁶ Ibid., May 24, 1750.

¹⁰⁷ SCHARF, vol. 2, p. 894.

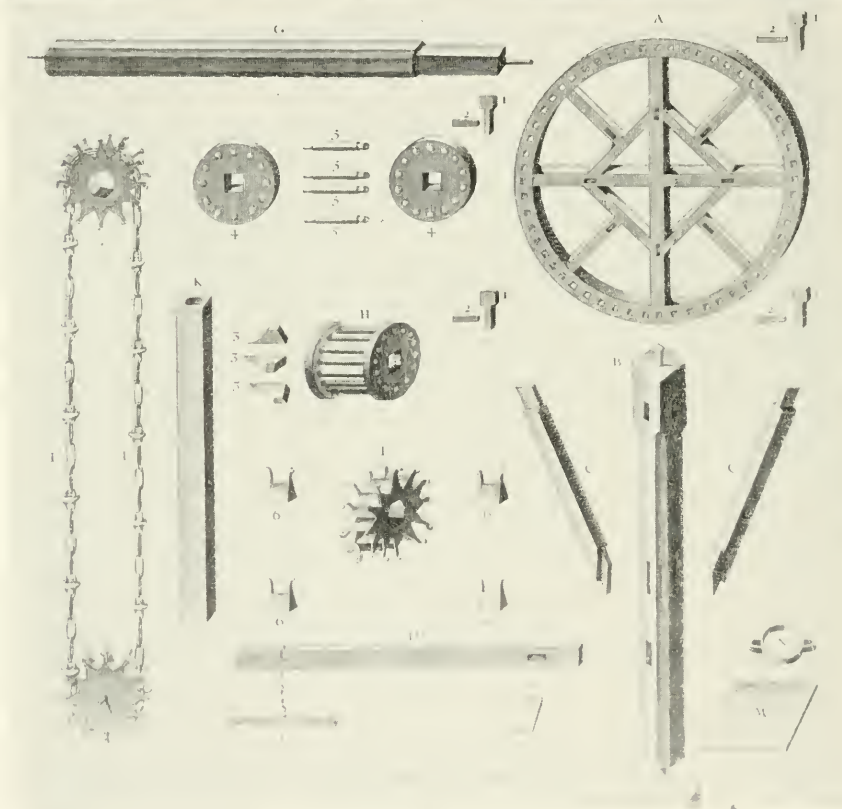
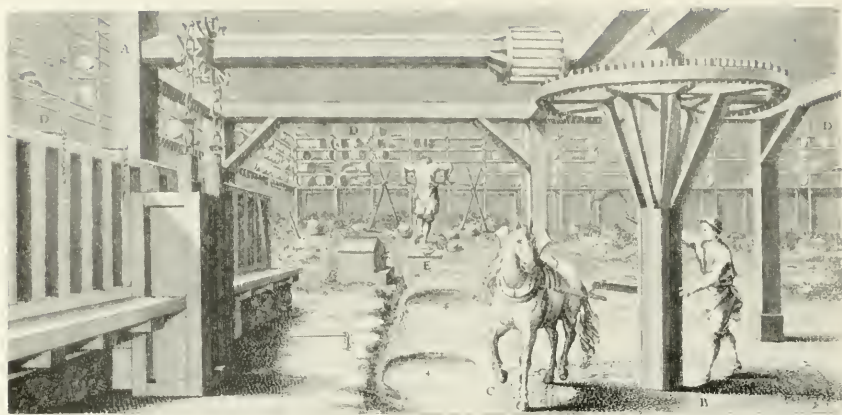


Figure 18.—Barkmill Detail, 1764. Horse Power and Wooden Gears. The detail of the bark mill from Lalande's "Art du Tanneur" (Duhamel) suggests the large cogwheel, face gears, and wallowers that geared Jacob Squibb's grinding mill at Newport, Delaware, early in the nineteenth century.

“from the Country all around, and from Maryland in great Plenty.”¹⁰⁸

Newport, much like New Castle, declined in importance with the rise of Wilmington and the coming of the railroad. After 1825, its fine road to the interior, its easy docking facilities, and its direct waterway to Philadelphia no longer attracted the manufacturing and commercial interests. Thus, the town’s once thriving tannery eventually gave way to the subsidiary activity of bark milling—an enterprise worth noting here only because of the excellent description of the mill carried in the *American Watchman* in 1825. Owned by Jacob Squibb, the mill was completely equipped to break bark before grinding it under one of three stones. The mill was horse powered, and its gearing consisted of “one large cog wheel 17½ feet in diameter, together with three other face wheels and three wallowers.”¹⁰⁹

Generally every town had a tannery, and Newark, Delaware, was no exception. In the 1760’s Hugh Glasford described his property and his tanner as well. As usual, the owner began by appraising his lot as—

a good Tanyard, with Water drawn by a Pump . . . and a large Bark-house, with about 80 cords of Bark therein, and a Mill-house with a good new Wheel therein; likewise a Brick Shoemaker’s Shop and Stove, and a Currying-shop, Tanning and Barking-irons, where Hides may be had very convenient; and Plenty of them, and Bark in great Quantities. Also a Negroe Man, that understands the Tanning and Currying Trades well, and has had the Smallpox and Measles.¹¹⁰

The first industry in Middletown, to the south of Newark, was a tannery operated by a man named Peterson,¹¹¹ and not far away at Odessa (Cantwell’s Bridge), near Appoquinimink Creek, William Corbit, whose elegant home still stands, built a tannery which operated until the scarcity of bark ended the business in 1854.¹¹²

Two miles north of Newark on the New London road, Thomas Crawford began a substantial country tanning and bark business

¹⁰⁸ *Pennsylvania Gazette*, October 7, 1762.

¹⁰⁹ Wilmington, January 14, 1825.

¹¹⁰ *Pennsylvania Gazette*, September 29, 1763. The tannery located at the east end of the town appeared for sale subsequently in the *Gazette* on July 11, 1765, and December 26, 1765. By the latter date, the tanyard was described as “a little out of Repair.”

¹¹¹ SCHARF, vol. 2, p. 998. In 1761 the Peterson tannery was purchased by David Witherspoon from the heirs of Adam Peterson. On February 11, 1825, the *Delaware Gazette* advertised a tannery at Middletown.

¹¹² McLane Report, vol. 2, pp. 756–757, lists Daniel Corbit. See also SCHARF, vol. 2, p. 1007; MUNROE, p. 30; and SWEENEY, *Grandeur on the Appoquinimink*, pp. 17–20.

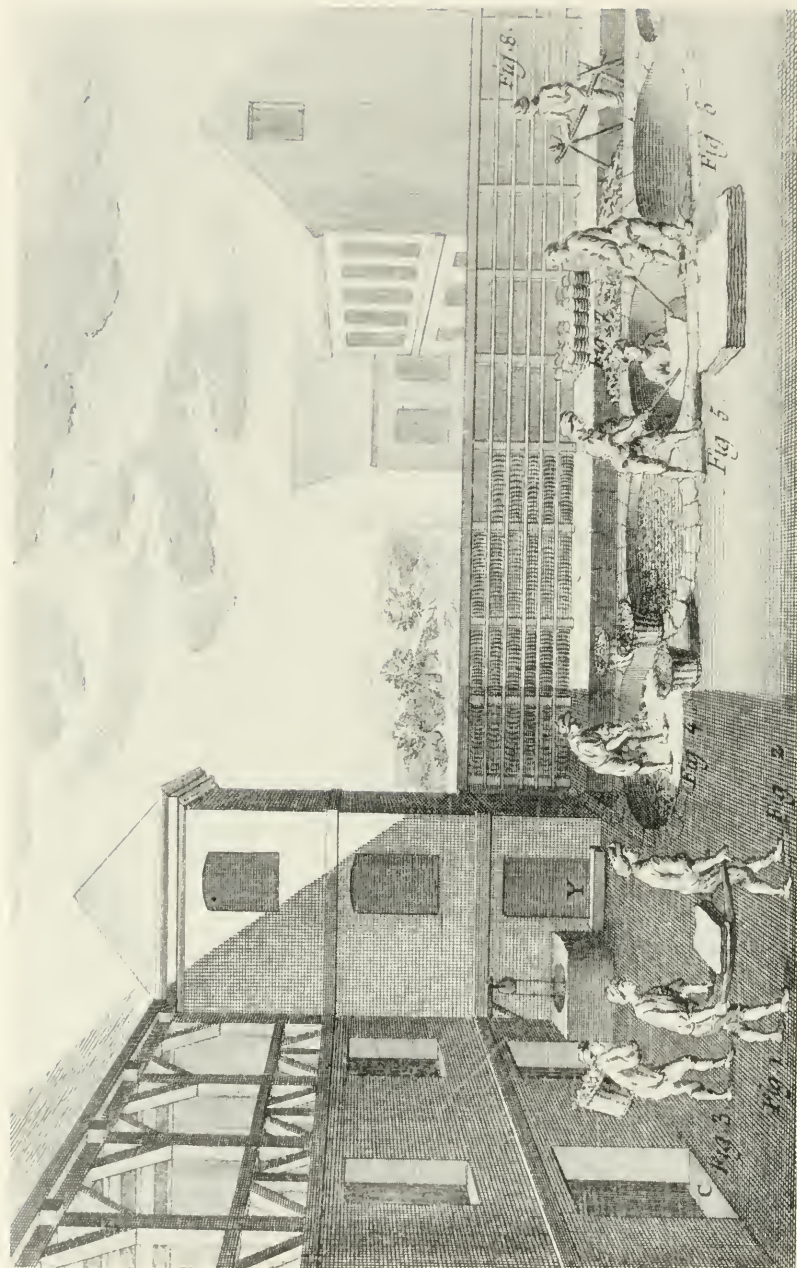


Figure 19.—The Tanyard. Diderot, 1771. In the 1760's the American tanyard generally lay open to the elements, less orderly but still much as depicted in Diderot's engraving. Not until later in the nineteenth century were the yards enclosed and the tanner freed from the caprices of the weather.

in 1829. Crawford's capital investment was \$6,000; he employed six men at a monthly wage of \$18; he tanned 500 hides and ground 350 cords of quercitron bark annually; and in 1832, Crawford voiced the same opinion as Isaac Jackson, namely, that the tanning trade had increased, but that the prices were too high.¹¹³ Crawford's tannery boasted an additional advantage. It was—

situated in a moral and respectable neighborhood, also for obtaining of Bark, it being on the road leading from the lower part of Chester County, where the most part comes from into our market. It can be had from three to eight dollars per cord, as seasons vary. From three to four hundred slaughter hides can be had yearly. The improvements are, a Bark house, 40 by 20 feet, with a Bark mill underneath, in complete order, Currying shop, Beam house, and Drying loft. Above the yard is paved with brick, which has 28 layaway vats, which will hold 78 hides each, with 5 latches drawing into a cistern that has two pumps worked by Horses power, Two limes, two bat[els] and two pools, with a spring of water passing through.¹¹⁴

Whether operating in town or in the country, New Castle County tanners and bark millers, as well as those in the lower counties, had in common many things aside from the tiresomely similar appearance of their tanyards: they bought hides in Wilmington, Philadelphia, New York, and Baltimore (both Spanish and domestic) and sold leather in the same places; they worked on an average of 10 to 12 hours per day, paying their men between \$15 and \$20 per month; they manufactured mainly sole leather from Spanish or South American hides; they ground black-oak bark for the quercitron trade, which was shipped all over the world; they preferred cash but sold their leather at three, four, or six months' credit, but the bark millers demanded cash; and most of them, when they expressed an opinion, felt that the last twenty years had been trying ones for the tanner.¹¹⁵ However, it was the consensus of New Castle County tanners that business prospects in 1832 looked brighter than they had for years. F. H. Holtzbecker best summarized this when he wrote: "Owing to [the] increase of internal consumption, occasioned by [the] increase in population, other manufacturing establishments, and exportation of shoes, boots, harnesses, etc.; the demand for all kinds of leather is considerably increasing."¹¹⁶

Downstate in Kent and Sussex Counties the same conditions prevailed. But, there, tanneries and bark mills had at least one

¹¹³ McLane Report, vol. 2, pp. 744, 756. ¹¹⁴ *Delaware Gazette*, January 20, 1837.

¹¹⁵ McLane Report, vol. 2, pp. 666 et passim. ¹¹⁶ *Ibid.*, p. 754.

advantage over those of New Castle County—they were located in the heart of Delaware's tanbark producing region. At Dover, in 1757, "a Tanyard, with the Tan-house, Mill and Pits all new," was advertised for sale or rent. This yard contained 20 vats and was located "in a very flourishing Part of the country, where a great Stroke of Tanning hath been carried on." The Dickinson plantation had a tanyard and among its Negroes were, "Taylors, Shoemakers, Tanners and Carpenters." At the main landing on the Mispillion a tanner was "much wanted" in 1764, Kent County being described as an area where a "great quantity of Hides may be brought very reasonably" and where "Bark is [in] great Plenty."¹¹⁷

By 1810, there were fourteen tanners in southern Delaware,¹¹⁸ and in the raw returns for the 1820 census the following bark mills and tanneries were reported in Sussex County:¹¹⁹

1 patent bark mill . . . 30 vats . . . 1 stone mill . . .	
Capital invested	\$3,500
2 patent bark mills . . . 100 vats	15,000
1 Stone mill . . . 15 vats	1,500
1 patent Mill going by Water, 1 stone mill	15,000
1 patent mill . . . 27 vats	—
1 patent mill . . . 30 vats	—
1 patent mill . . . 22 vats	—
1 common mill with one stone	—

In Frederica, Thomas Clark had been in the tanning business since 1792.¹²⁰ In 1821, he tanned 500 Spanish and 500 country hides a year, employed six men and two boys, operated three bark mills, and had 74 tan vats.¹²¹ Clark estimated in 1832 that his profits were about ten percent on his investment per year.¹²²

A typical tannery of the 1820–1830 period in southern Delaware, again like those to the north—

Comprised . . . a lot of ground of about one half acre. There is on the prem-

¹¹⁷ See *Pennsylvania Gazette*, August 4, 1757, and June 23, 1763 (the property was first advertised by William Walker and later by William Morris); also January 5, 1764, and November 22, 1764.

¹¹⁸ *American State Papers* . . . , *Finance*, vol. 2, p. 764.

¹¹⁹ Census Schedule of tanneries in Dagsborough, Little Creek, Broad Creek, Baltimore, Indian River, Nanticoke, and Northwest Fork Hundreds; Census of 1820. The McLane Report, vol. 2, p. 666, provides detailed information about Sussex tanneries owned by Robert Houston (founded 1810); John Richards (1811); Hall & Hazzard (1819); and William Tunnell (1824).

¹²⁰ McLane Report, vol. 2, p. 676.

¹²¹ John and Thomas Clark, in Census Schedule 1821.

¹²² McLane Report, vol. 2, p. 677.

ises about 150 deposits for hides, a Bark House about 22 by 82 feet, built of good materials and is nearly new, a Mill house with a Mill lately built for grinding quercitron bark; also, an Iron Mill, Beam House, Handling House, Carrying Shop, and Stable for four horses.¹²³

Occasionally, an individual processed only bark; one such establishment was owned by Joseph Oliver, who entered the bark business in 1815 at Milford in Kent County. Oliver's grinding mill was water powered, and from it came 1500 tons of bark, which sold for around \$40 a ton, amounting to \$60,000 annually. Most of Oliver's bark was shipped to Philadelphia and New York, and from there frequently exported either to "Great Britain, France, Russia and Germany," or sent to "the New England manufacturing States." Not all of Oliver's bark was shipped out of the state, for in the 1820's he was supplying A. Cardon and Company in New Castle County with black oak. Oliver's mill was a large-scale operation. He employed "fifty able-bodied men" and worked them "twelve hours each day" for "mostly the whole year" at an average wage of about seventy-five cents per day. One of Oliver's few worries was the "discovery of a number of substitutes" for tanbark.¹²⁴

Another large tannery, at Smyrna in southern Delaware, belonged to John and Alexander Peterson and dated from 1782. Sole leather was their principal product in 1832, and their investment in buildings, vats, mills, and pumps was \$7500; their total capital investment was about \$25,000. The Petersons employed nine men at an average wage of \$15 per month. This was, according to them, above the usual wage for agricultural laborers which "in this district is from ten to twelve dollars per month when they board themselves, [and] from five to seven dollars . . . when boarded." The tanning business in Smyrna was so improved by 1832 that the Petersons intended to convert their horse-powered mill to waterpower "this present year." Like their upstate competitors, a few tanners in southern Delaware noted some improvement in business generally, and the gradual upswing prompted a cautious optimism that envisioned a ten-percent profit on capital invested if, of course, the enterprise was "judiciously managed."¹²⁵

¹²³ *Delaware Gazette*, March 3, 1826. The property was at Salisbury (Old Duck Creek) in Kent County and was advertised by Robert Patterson and P. Spruance, Jr. See also the *Gazette* advertisement of April 23, 1824, for a tanner at Leipsic in Kent County.

¹²⁴ McLane Report, vol 2, pp. 673-674. Oliver frequently did business with A. Cardon and Company, as will be seen in the following chapter.

¹²⁵ McLane Report, vol. 2, pp. 666-667.

Generally, though, the years before 1830 were often described by Delaware tanners as difficult ones. Isaac Starr noted that "One half of the tanners in this State, have within the last twenty-five years, either failed, reduced their business, or retired from it."¹²⁶ Starr's opinion was echoed throughout the state. In fact, not only the tanners had lost their optimism but the manufacturing interests in general were glum and their grand vision of making Wilmington an American Manchester had by 1833 been concluded as wishful if not "abortive."¹²⁷ There were many reasons: embargo, war, depression, and the lack of a protective tariff. But, mainly in the 1820's, the factors most harmful to the tanner were the low price of leather, the high cost of raw materials (principally bark), competition from the large tanneries in the hemlock regions of New York and western Pennsylvania, and a failure to adopt the latest "patented inventions."¹²⁸ One tanning concern in Wilmington, Jackson and Webb, attributed the tanner's plight to the shortage of and subsequent high cost of Spanish hides—a situation brought about by the revolutionary wars in South America.¹²⁹ Tanning had rivaled shipbuilding and flour milling as Delaware's principal industry in the 18th century,¹³⁰ and, regardless of its many problems, the state's leather and bark trade as late as 1832 still ranked behind flour, textile, and paper milling in the amount of capital invested, the number of men employed, and the value of its product.¹³¹

Yet the tanneries showed little sign of technical progress, whereas in other Delaware industries innovation had been constant: Oliver Evans had mechanized flour milling; the Gilpins had speeded paper production; Jacob Broom, as early as 1795, had built an Arkwright-type textile mill powered by water; and the du Ponts had completely rationalized the production of gunpowder. Tanning, however, remained unchanged, and with little variation the production of leather continued in the same slow and tedious manner that had been characteristic since the seventeenth century—an occurrence not restricted to Delaware alone.

¹²⁶ McLane Report, vol. 2, pp. 750-751.

¹²⁷ *Delaware Gazette*, October 8, 1833.

¹²⁸ McLane Report, vol. 2, p. 751. This is undoubtedly true even though Delaware newspapers reported new patents and tanning processes. See *American Watchman*, December 11, 1816.

¹²⁹ Census Schedule, May 1821.

¹³⁰ LINCOLN, *Wilmington, Delaware: Three Centuries under Four Flags, 1609-1937*, pp. 265-266.

¹³¹ McLane Report, vol. 2, pp. 778-779.

Chapter IV

*A. Cardon and Company, 1815-1826*¹³²

"He will be a satisfactory tanner and in twenty years from now very wealthy; the only way to be respected in this English country."—*du Pont de Nemours, 1816*

The construction of the du Pont gunpowder mills along the Brandywine was well underway in the spring of 1803 when E. I. du Pont wrote to his father requesting all the information available concerning "Seguin's new process of tanning."¹³³ Knowing that this new method had shortened the time required to tan sole leather from two years to several months, du Pont had mentioned it to a neighboring Delaware tanner and was told that "his fortune would be made if he could do the tanning by so prompt a method." He continued:

Please tell me what this discovery amounts to in France; whether it is used on a large scale; whether it has been improved; whether it is really as economical as Seguin asserts; and whether he appears to have made a fortune by it. I wrote to Seguin about it when I was last in France, but he did not answer as I expected and contented himself with referring me to the various descriptions of it that had been published. I have here the accounts by Le Lièvre and Pelletier which were in the *Annales de Chimie*. I cannot find one by Fourcroi, which we printed, that by Chaussier, which was published in the *Journal de l'Ecole Polytechnique*, nor the one by Vouquelin, which was in the *Lycée des Arts*.¹³⁴

The accounts read by du Pont were not detailed enough to satisfy him. All were termed "too vague and superficial to be of any use for establishing the process."¹³⁵

By 1807, however, E. I. du Pont was again considering entering the tanning business provided, of course, that Seguin's process was as superior as it was said to be. Characteristically, du Pont was convinced that "we must learn his methods thoroughly before we can put them to practical use."¹³⁶

But why the renewed interest in establishing a tannery? Primarily, it was to find a satisfactory occupation for Victor du Pont, whose

¹³² This chapter, in slightly different form, first appeared in *Delaware History*, the journal of the Historical Society of Delaware, and is reproduced here through the courtesy of the Society.

¹³³ E. I. du Pont to du Pont de Nemours, April 28, 1803, in B. G. du Pont, ed., *Life of E. I. du Pont . . .*, vol. 5, p. 212.

¹³⁴ Ibid.

¹³⁵ Ibid.

¹³⁶ B. G. du Pont, op. cit., vol. 7, p. 298.

activities in America had always been somewhat less than successful. His brother felt it was "imperative . . . to help him find something more worthy of him and his education." In 1807, a tannery seemed "to be the most hopeful business,"¹³⁷ but by November of 1809 interest had shifted to a woolen mill. Here was a new business where "industry and information" were needed, "and not everyone has them." Tanning, on the contrary, was "a trade that everyone can follow and does; the country is full of tanneries, each doing a small business." E. I. du Pont continued his comparison of leather and textile manufacture:

We could not think of making tannin here for exportation to Europe; bark costs as much here as at Nemours; it is somewhat cheaper in the backwoods but there are no laborers there. The Peace will not injure our cloth mills as you fear; all manufactured goods can succeed in this country, and this kind at least as well as any other.¹³⁸

Despite these objections the father, not easily discouraged, continued to press for the establishment of a tannery. Du Pont de Nemours was so determined that he went to some lengths to partially explain Seguin's process:

Seguin's method with leather is only the perfecting of *juicy* tanning, of which I have sent you two good descriptions. This *juicy* method was an improvement of the original art; it worked faster and better. In writing of his method, Seguin said, "By wetting the leather with the juice of the tan collected from the lower part of the tan pit and saturating the tan that has not given out all of its astringent property several times with this juice, the tanning is done better and more quickly than by leaving it in the bottom of the pit and allowing the tan to separate slowly. I can do still better and quicker work by preparing in advance and in such quantities as I wish juice of tan impregnated with the astringent and keeping my leather in a perpetual bath of it. He really did it much quicker, but not much better—perhaps rather less well. . . . But it was a distinct advantage to accomplish in two or three months what had before been a matter of a year—fifteen or eighteen or twenty-one months—sometimes two years. The profit on the capital in labor and interest alone was enormous. And he would have gained in quality as well as in time if he had allowed five or six months instead of two or three."¹³⁹

Du Pont de Nemours also answered the objections regarding the availability of bark and tannin:

I thought that on the Brandywine you had many oaks of different varieties and other trees even richer in *tannin*, or a more astringent tannin than that of our European oaks. If they are found only in the backwoods, would it

¹³⁷ B. G. du Pont, op. cit., vol. 7, p. 298.

¹³⁸ B. G. du Pont, op. cit., vol. 8, pp. 230-231.

¹³⁹ du Pont de Nemours to E. I. du Pont, January 26, 1810, in B. G. du Pont, op. cit., vol. 8, pp. 256-257.

not be a good investment, or a remunerative industry, to combine tanning with saw mills . . . , and could not the rivers carry down casks full of the juice of tan—or liquid tannin—as they now do wood for building and potash.

Finally, on one point the father agreed with his son: “It is certain that your Americans make a great deal of leather and make it very badly; it absorbs water like a sponge and does not wear at all.”¹⁴⁰

Apparently, after this exchange the discussion was dropped—Victor built a woolen mill across the Brandywine from the powder yard, a cotton mill had been built at Hagley, the powder business occupied most of Irénée’s time, and with the War of 1812 came the expansion of the company as well as difficulties within the partnership; collectively, these factors ended for a time any new enterprise. Not until du Pont de Nemours decided to return to America did the subject of a tannery again appear in the du Ponts’ correspondence.

Sophie M. du Pont reveals in her memoir: “When Grandpapa came to America in 1815 . . . he could not very well make the trip alone.”¹⁴¹ Maurice de Pusy, who was to have accompanied the elder du Pont, decided not to come, and, as a consequence, Alexandre Cardon de Sandrans came to the Brandywine in the spring of 1815 as du Pont de Nemour’s companion and secretary.¹⁴²

The desire to have everyone associated with him gainfully employed seemingly caused Pierre Samuel to once again think in terms of a tannery. But now, instead of Victor du Pont, it was

¹⁴⁰ Ibid., pp. 257–258.

¹⁴¹ SOPHIE DU PONT, “Brother Remembers,” Winterthur MSS, 1, group 9, box 90; Eleutherian Mills Historical Library, Greenville, Delaware.

¹⁴² Little is known of Alexandre Cardon de Sandrans. *Baron Klinkowström’s America, 1818–1820*, Franklin D. Scott, ed. and transl. (Evanston, 1952), p. 54, states that Cardon’s father had been a member of the constituent assembly, presumably Joseph de Cardon, Baron de Sandrans, who was a “deputy of the nobles of Bresse to the Estates General in 1789.” Klinkowström refers to young Cardon as “Baron Sandran” and states that he had been a member of the *Garde du Corps* until reorganization of the regiments of France had left him dissatisfied and ready to leave the country. Du Pont de Nemours’ correspondence confirms Klinkowström and gives insight into Cardon’s personality, which was apparently that of a young aristocrat suddenly stripped of rank and prestige and forced to work for a living for the first time in his life.

Cardon’s personal life on the Brandywine is as obscure as his early life in France. From the business records of A. Cardon and Company one is able to draw a fair picture of Cardon the business man, for the years spent on the Brandywine. After 1825, Cardon moved to Harrisburg, where he invested in a tannery and later in an ironworks. The meager evidence uncovered indicates that he and his family hoped to return to Europe in 1833, thus turning their backs on the New World as well as on their many creditors. As late as 1837, Cardon was still in this country. In addition to Scott, material relating to Cardon may be found in the Old Stone Office Records, and in the Longwood MSS, Eleutherian Mills Historical Library, Greenville, Delaware.



TANNERS' PRIVATE STUDY AND LABORATORY.

Figure 20.—Management and Labor, 1850. No pictorial record survives for Cardon's tannery. David H. Kennedy's *Art of Tanning Leather* includes en-

Cardon de Sandrans that concerned him. Cardon was apparently unhappy in America and as early as July 24, 1815, he was "thinking of returning to Europe."¹⁴³ As du Pont's secretary, he had been earning only about fifteen dollars a month, and his plans for opening a calico-printing factory had been abortive.¹⁴⁴

The arrival of another emigrant eager to succeed in the New World soon changed Cardon's plans. In August, Madame du

¹⁴³ du Pont de Nemours to wife, letter no. 8, July 24, 1815, Longwood MSS, access. 47, Eleutherian Mills Historical Library.

¹⁴⁴ Ibid., June 25, July 24, 1815. Cardon had planned to enter the textile venture with J. A. Bidermann. Young Bidermann, son of a French banker, had come to Delaware in 1814 as a representative of the du Pont Company's European investors, who were concerned over their American investment. Finding E. I. du Pont an able manager, Bidermann remained in Delaware and, in 1816, married Evelina Gabrielle du Pont. Bidermann played an important role in the powder company, and he soon became E. I. du Pont's most trusted lieutenant. The production of gunpowder and not the leather business occupied most of his time. When du Pont died in 1834, Bidermann became the head of the du Pont company, serving in this capacity until 1837. After a short visit to France, he returned to Delaware where he made his country seat, Winterthur, one of the best and most productive farms in the state. In 1863, after the death of his wife, Bidermann returned to France to live with his son, James Irénée Bidermann. Bidermann died in Paris in 1865.



TANNERS SINGING THE "TANNERS' CHEER," ADAPTED TO THE TUNE OF THE MARSEILLAISE HYMN.

gravings which vividly picture certain aspects of the tanner's life in the mid-19th century: the contrast of management and labor, the increased attention to chemical principles, and the continued influence of the French.

Pont wrote to her husband introducing this newcomer to the Brandywine:

I am sending you this letter . . . by M. Chenou . . . This gentleman has made a very practical discovery concerning a method of tanning leathers. You will have no difficulty understanding it, since you have worked so long and hard for the tanners and tanneries. M. Chenou would like to find an established tannery and associate himself with it—contributing his process, which has been recognized as excellent in Paris.¹⁴⁵

Chenou had come to the right place. He arrived in Delaware late in 1815, and by December, Alexandre Cardon and J. A. Bidermann had entered into an agreement under the name of A. Cardon and Company, "the object of which was the tanning of leather by a new process." It is not clear what transpired among du Pont de Nemours, Cardon, Bidermann, and Chenou,

¹⁴⁵ Wife to du Pont de Nemours, August 25, 1815, Winterthur MSS, 1, group 2, box 37, Eleutherian Mills Historical Library.

Le Li. d'Association pour
l'établissement d'une Tannerie et d'une
Fabrique de Haroquin.

Les Soussignés Alexandre
Lardou de Landrou, Charles Ducloux,
Auguste Gautremont et Jacques Salin
McDermann, voulant établir une Tannerie
et une fabrique de Haroquin sur le
Rivage de la Rivière de Haroquin.
Ont d'abord de l'unanimité adopté
une Société et arrêté les articles suivants.
Art. 1^{er} Les fonds de l'établissement
seront fournis ainsi qu'il suit:

\$ 2000 = Par Alexandre Lardou de Landrou
(vingt mille Dollars).

1000 = Par Charles Ducloux. Mille Dollars.

1000 = Par Auguste Gautremont Mille Dollars.

2000 = Par M. J. McDermann Vingt mille

\$ 6000 (Dollars).

Chacun des Sociétaires souscrits s'est
engagé personnellement d'acquiescer à la mise
des fonds pendant le cours de la prise en
charge.

Art. 2^e La gestion de l'établissement
sera confiée à M. Lardou de Landrou et à
M. J. McDermann; le premier sera
principalement chargé de la fabrication
des cuirs et des Haroquins, des achats
des bœufs et des voyages que le Com.
de l'établissement pourra nécessiter.
Le second s'occupera de la comptabilité
et de la tenue des livres et assistera le
premier autant que possible dans les
travaux de fabrication &c. Les frais
de voyage ainsi que les dépenses de
courant &c. seront payés par
l'établissement.

Figure 21.—A. Cardon and Company Articles of Agreement, 1815.

or why Chenou chose to stay on the Brandywine. The result was that "A. Cardon & A. Bidermann being entirely unacquainted with the business made an arrangement with a Mr. L. F. Chenou . . . who engaged to remain with them one year and teach them his process of leather and morocco manufacturing."¹⁴⁶

Du Pont's sense of responsibility for Cardon was somewhat relieved. He confided to his wife: "I am certainly happy that coming over with me has not brought him ill luck." It seemed to du Pont père that Cardon had "formed here a very worthwhile and lucrative business" which "in America . . . is the only way to gain respect." It was fortunate that both Cardon and Bidermann had learned a trade from Chenou because, according to du Pont de Nemours, "in this country the profession of a man who knows only how to write is less than nothing. That of wood-cutter or barrowman is much better."¹⁴⁷

In February 1816, a tannery was in operation and those involved had "high hopes for it."¹⁴⁸ What had begun as a project to employ Victor du Pont resulted in a new industry on the lower Brandywine. A young nobleman, a banker's son, and a tanner (all recently arrived in America) joined the Brandywine's industrial family, pursuing a business which could not fail. After all, what could be better than a tannery in a country where "nobody goes bare-foot and nobody wears wooden shoes. There are throngs of consumers."¹⁴⁹ Du Pont de Nemours' responsibility for A. Cardon was discharged: "He will be a satisfactory tanner and in twenty years from now very wealthy; the only way to be respected in this English country."¹⁵⁰

By December 1815, Alexandre Cardon, Charles Dalmas, and J. A. Bidermann had "subscribed . . . as follows to furnish a capital stock of \$6000—for settlement of a Tan Yard and Morocco manufactory [see fig. 21] under the name of A. Cardon & Co."¹⁵¹

¹⁴⁶ "Statement written by Bidermann with additions by E. I. du Pont," in B. G. du Pont, vol. 11, p. 251. In addition see Agreement between Alexandre Cardon de Sandrans, Jacques Antoine Bidermann, and Louis François Chenou, December 29, 1815, Eleutherian Mills Historical Library. Chenou agreed to teach Cardon and Bidermann a method of tanning which would produce finished leather in three months.

¹⁴⁷ du Pont de Nemours to wife, letter no. 65, October 9, 1816, Longwood MSS, access. 47.

¹⁴⁸ du Pont de Nemours to wife, letter no. 32, February 22, 1816.

¹⁴⁹ du Pont de Nemours to wife, letter no. 46, June 12, 1816.

¹⁵⁰ du Pont de Nemours to wife, letter no. 70, November 26, 1816.

¹⁵¹ Day book, 1815–1822, A. Cardon and Company, Old Stone Office Records, Eleutherian Mills Historical Library, Greenville, Delaware, December 29, 1815. These records will hereafter be cited as OSOR.

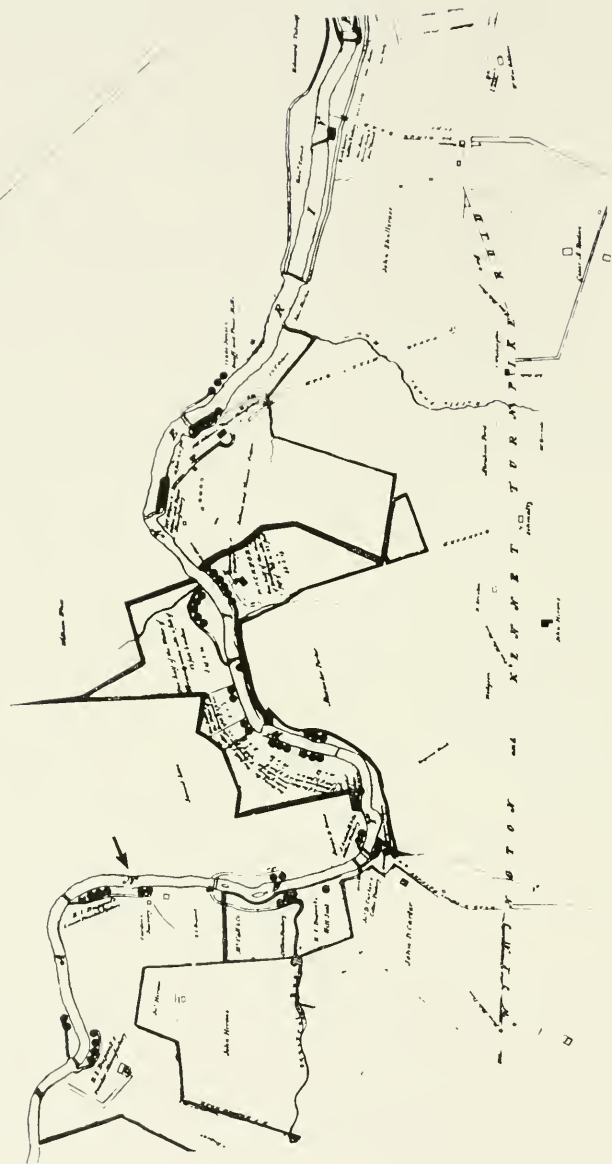


Figure 22.—Millseat Survey, 1822. The addition of a tannery in 1815 increased the diversity of manufacturing interests located on Brandywine Creek. Roughly five miles from Wilmington, the near neighbors of A. Cardon and Company (arrow) as shown in the survey of 1822 included textile millers, gunpowder makers, machinists, and paper manufacturers.

A. Cardon de Sandrans	\$2000
Ch. Dalmas	2000
Ant. Bidermann	2000
	\$6000

Dalmas was “a sleeping partner” with the management of the business left to Cardon and Bidermann.¹⁵² Within a year Bidermann’s ever-growing responsibilities in the powder business required most of his time; thus, very early, the operation of the tannery became Cardon’s responsibility. It is interesting to note that of the initial capital of \$6000, E. I. du Pont advanced \$3700—\$2000 for Dalmas and \$1750 for Bidermann—and that during the first year of business the du Pont Company met most of the firm’s obligations.¹⁵³

Counting the gunpowder, cotton, and woolen mills previously built with du Pont energy and capital, du Pont de Nemours called the tannery the “fourth mill established on our stream.”¹⁵⁴ This newest venture was located “on a piece of ground and in buildings which belonged to our second powder mill, around a quarter of a league away,” from Eleutherian Mills—the site of du Pont’s first powder mill (see fig. 22).¹⁵⁵ For the “Rent of Tann yard, Bark Mill & Dwelling House” to December 31, 1818, Cardon had paid E. I. du Pont \$400; in the years following, du Pont received \$200 annually for the yard and \$100 for Cardon’s quarters.¹⁵⁶

The business went well. By the end of 1816, the first leather was produced by the new company,¹⁵⁷ “but every beginning is difficult.”¹⁵⁸ Just as the first leather was to be taken out of the vats, Chenou, having “taught the secrets of the tannery to Sandran and Bidermann,” departed for New Orleans.¹⁵⁹ At the time, du Pont de Nemours wrote:

¹⁵² See “Statement written by Bidermann,” in B. G. du Pont, vol. 11, p. 252. Charles Dalmas (1777–1859) was E. I. du Pont’s brother-in-law, and had accompanied the du Pont family to America in 1799. Like Bidermann, Dalmas was associated with the gunpowder company and had little to do with the tannery.

¹⁵³ Day book, December 31, 1815, et passim.

¹⁵⁴ du Pont de Nemours to wife, letter no. 87, May 3, 1817, Longwood MSS, access. 47.

¹⁵⁵ du Pont de Nemours to wife, letter no. 65, October 9, 1816. Eleutherian Mills had been purchased by E. I. du Pont in 1802. Hagley, a strip of land immediately adjoining the first site, had been purchased in 1813.

¹⁵⁶ Day book, May 31, 1819, et passim.

¹⁵⁷ Day book, October 1816.

¹⁵⁸ du Pont de Nemours to wife, letter no. 88, May 16, 1817, Longwood MSS, access. 47.

¹⁵⁹ du Pont de Nemours to wife, letter no. 87, May 3, 1817.

Not being able to learn English, he [was] bored in our valley and . . . asked them to cancel the contract he had made with them . . . They have consented and think they can get along all alone.¹⁶⁰

But in 1830, E. I. du Pont, with the advantage of hindsight, was less charitable:

After a few months and before any leather had been made ready for sale Chenou probably foreseeing that the result of the first year would fall far short of his expectation communicated his desire to retire before his engagement expired, and as A. Cardon professed himself quite able henceforward to manage the business alone . . . a sum of money was paid to the latter and he went away.¹⁶¹

However, in November 1816, E. I. du Pont wrote to New Orleans recommending "Mr. L. F. Chenou who is going to your place with the intention to begin there the tanning business with which he is very well acquainted."¹⁶² After Chenou's departure, Cardon managed "the fabrication, purchase, sales &c." and when he found time, Bidermann kept the "accounts and books."¹⁶³

In October, Guillaume Merle d'Aubigné came to "the shores of the Brandywine—to visit the establishments of Mr. du Pont de Nemours." After mentioning "two large powder mills" and a cotton mill, he described "a large tannery by some new method where in 4 months they tanned sole leather as well as had previously been done in 15. Besides they are making all kinds of leather for harness—morocco, &c., &c., &c."¹⁶⁴ The following week, November 7, 1816, the *Delaware Gazette* carried the advertisement of a local merchant who was to sell Cardon's leather.

Hatters, Coachmakers, Shoemakers, &c.
Look Here!

H. J. Pepper, *No. 60 Market-street, Wilmington*, Informs the public that he has on hand, and intends keeping constantly, a large and general assortment of *Morocco's; Boots, Shoe, and Soal Leather*, From the Manufactory of Messrs. A. Cardon & Co. which he will sell at the factory prices.

"Hard weather" stopped operations briefly in the winter of 1816–1817,¹⁶⁵ but by June the company again solicited curriers to

¹⁶⁰ du Pont de Nemours to wife, letter no. 74, December 27, 1816.

¹⁶¹ "Statement written by Bidermann," B. G. du Pont, op. cit., vol. 11, pp. 251–252.

¹⁶² Letter book, 1815–1817, E. I. du Pont de Nemours and Company, November 27, 1816 (OSOR).

¹⁶³ "Statement written by Bidermann," B. G. du Pont, op. cit., vol. 11, p. 252.

¹⁶⁴ *La vie Américaine de Guillaume Merle d'Aubigné; Extraits de son Journal de Voyage et de sa Correspondance inédite, 1809–1817*, with introd. and notes by Gilbert Chinard (Paris, 1935), p. 113.

¹⁶⁵ Letter book, 1816–1827, A. Cardon and Company, March 8, 1817 (OSOR).

finish their leather. Unfortunately the older, more reliable Philadelphia concerns were not interested in handling the leather of a new tannery at a time when cash was scarce and credit tight. Rebuffed, Cardon turned to E. I. du Pont's agent in Philadelphia:

E. I. Dupont de Nemours & Co. gave us the hope that you would undertake to sell the produces of our tannery in Philadelphia & consequently we take the liberty of sending you this day four bundles of sole leather We do not suppose that you could keep the said leather at your own store, as the shoe makers are accustomed to take it only from curriers, but our intention is that you would put them at some of the curriers where you think they will sell the best and as we can not go often in Philadelphia ourselves, that you would attend to our business with them. Mr. Singers who are very rich & have a great number of customers, like to sell only for tanners who take the hides from them, they have not encouraged us to have our leather in their store and we think it would be well to look for some other.

Continuing, Cardon pointed out:

The leather that we send you is extremely well tanned and perhaps better than any in the market; but by some accident, is not what it will be in the future and is a little too dark which is against its appearance. For that reason we wish that you will not mention that it comes from our factory.¹⁶⁶

This letter reveals the specialization within the leather trade as well as several ominous signs: first, in attempting to establish a new account, Cardon and Company consigns leather which is admittedly below par; second, they are too willing to turn over one of the most important aspects of their business—leather sales—to an impersonal commission merchant; third, they exhibit a certain naïveté in hoping that their name will not be associated with a poor quality leather; and, finally, by circumstance they are forced to deal with smaller, less dependable firms in Philadelphia.

At first a variety of leather was manufactured at Hagley: "We make . . . a considerable quantity of calf skins and some harness leather, both of the first quality and highly finished."¹⁶⁷ (A detailed account of the process of making Morocco leather may be found on pages 88–90.) But after three years the "Chief business" was "tanning of Sole leather,"¹⁶⁸ although red and black morocco continued to be produced from sheep and goat skin. The black goat was for the coachmakers, the yellow sheep for the hatters. In addition Cardon and Company tanned boot linings and "cut

¹⁶⁶ Letter book, 1816–1827, A. Cardon and Company to John Vaughan, June 30, 1817.

¹⁶⁷ Ibid.

¹⁶⁸ Letter book, March 1, 1819.

boot legs of every kind,"¹⁶⁹ and in 1824 they even purchased "20 Buffalo Hides" which presumably were tanned.¹⁷⁰ Leather from Hagley sold in Philadelphia for twenty-six to thirty cents a pound and was presumed by the manufacturer to be "among the best in this Country."¹⁷¹

Baron Klinkowström "saw a bundle" of leather at Hagley in March 1818 tanned by a new process. The process was undoubtedly the Seguin method or a slight modification of it, and Klinkowström judged the leather produced "as fine as West Indian leather in firmness and strength." A less reliable observer, John Palmer, was also impressed by this process of tanning which tanned "a hide as well and as thoroughly in two months as in ten years." When Klinkowström had inquired about Cardon's methods he found it was a secret, one which would "not be a mystery for any long time here."¹⁷² Unfortunately, research has not verified Klinkowström's prediction and, even today, the exact details of Cardon's technique remain a mystery.

The firm's business practices were more conventional than their methods of tanning. Like other tanners, they usually purchased hides from curriers and returned leather in payment. The currier then sold the leather at a two and one-half to three percent commission, after which he credited the tanner with the proceeds of the leather sales. In the case of Cardon and Company, the account usually was in the currier's favor, with Cardon merely receiving credit for the leather sold to be applied against the next order of hides.¹⁷³

By 1821, the "Tan Yard at Hagley on the Brandywine" processed 3000 hides and 350 cords of bark annually. The cost of raw material (bark and hides) was \$12,000, and the eight men employed by the firm received a total of \$2400 a year in wages. Cardon listed the product manufactured as "Principally Sole leather," with no mention of morocco. The capitalization of the firm now stood at \$16,000, but by Cardon's own admission "the increase of the prices of raw Hides which has lately taken place, and the depreciation in the price of leather render at present this Branch of manufacture

¹⁶⁹ Letter book, June 27, 1817. See also letters of April 15 and November 3 and 4, 1817.

¹⁷⁰ Day book, 1823-1827, A. Cardon and Company (OSOR).

¹⁷¹ Letter book, A. Cardon and Company, March 1, 1819.

¹⁷² Scott, *op. cit.* (footnote 142), p. 54; and Palmer, *Journal of Travels in the United States of North America*, p. 21.

¹⁷³ Letter book, A. Cardon and Company to Timothy Abbott, July 11, 1824.



Figure 23.—Laying Away the Hides. The physical remains of Cardon's building (still standing on the grounds of the Hagley Museum at Wilmington, Delaware) suggest that at least some of the tan vats were housed and not typically exposed in an open tanyard. This scene from Davis' *Manufacture of Leather* approximates the appearance of the Cardon tannery.

unprofitable.”¹⁷⁴ Cardon was expressing a view similar to that of most tanners. Furthermore, the size of his tannery was comparable to the larger ones in the area, with approximately eighty-six vats, several outbuildings, and a bark mill.¹⁷⁵ (See fig. 23.)

Actually, Cardon and Company typifies the operations of most manufacturers of the period, especially in regard to the use of transportation and the procurement of raw materials. The Brandywine tanners used most of the existing transportation facilities. The shallop, the packet, and the steamboat, as well as the Philadelphia stagecoach, wagons, and even a sleigh¹⁷⁶ carried

¹⁷⁴ Census Schedule, 1821, A. Cardon and Company (The National Archives).

¹⁷⁵ See accounts current, A. Cardon and Company, 1815–1829 (OSOR); specifically, E. I. du Pont de Nemours and Company in account with A. Cardon and Company, December 31, 1828; December 31, 1829. In addition, see bills miscellaneous, A. Cardon and Company (OSOR, Tannery, box 1), undated.

¹⁷⁶ Letter book, December 13, 1821.

hides or transported leather between Wilmington and the principal markets of Philadelphia, Baltimore, and New York. The river and the turnpike roads were the main arteries. The Warner packet was used for freight, either the sloop *Mary Ann* or the sloop *Fame*, but for business trips to Philadelphia Cardon preferred the steamboat.¹⁷⁷ For a "Journey to Philadelphia" on September 5, 1817, he submitted the following expense account:¹⁷⁸

Steamboat going	1.00
Breakfast	.50
Stamp paper	.35
Stay in Philadelphia	7.50
Steamboat coming back and baggage	1.25
	10.60

Brandywine 9ber 9th 1817

A. Cardon.

A tannery required a variety of raw materials and services. The obvious ones were hides and bark, but others were necessary, such as dyes, acid, and lime, as well as the services of wagoners, smiths, and millwrights. A ready source of hides was a prerequisite, and the regional cattle industry provided an abundant supply. To supplement this, Delaware tanners turned to Philadelphia, Baltimore, or New York.

Typically, Cardon sought hides wherever he could find them and bought wherever the price was right. The South American hides were desired for sole leather in the early nineteenth century, and these were obtained from various sources. For example, Cardon wrote to John Vaughan in Philadelphia:

We yesterday saw in the papers the arrival of the Ship Hope from Montevideo with Hides consigned to G. Strawbridge. Would you be so kind as to ascertain if the hides are of 1st. quality . . . [and] what price is asked.¹⁷⁹

Similarly, through importers in Baltimore, Philadelphia, and New York, hides from Buenos Aires, La Plata, and La Guaira were obtained for tanning at Hagley.¹⁸⁰

The trade in hides took many forms, and the following letter to a Baltimore merchant is typical: "Let us know the time you might be ready to send on the Hides that we could send a waggon load

¹⁷⁷ Letter book, December 9, 1816, et passim.

¹⁷⁸ A. Cardon's expense statement, November 5, 1817, in bills miscellaneous, Cardon and Company (OSOR, Tannery, box 1).

¹⁷⁹ Letter book, Cardon and Company, March 9, 1822.

¹⁸⁰ Letter book, Cardon and Company, December 4, 1819; January 12, 1822; and January 19, 1822.

of leather and bring back a load of Hides.”¹⁸¹ Not all imported hides were good. More often than not they were worm eaten and rotten, being described, quite aptly, as putrid. Often the stench of hides, fleshings, and remainders was the tannery’s most distinguishing characteristic. In 1819, Cardon received such a shipment from Philadelphia and to his disgust found “none of the Laguira Hides . . . worth Tanning” nor “the Buenosayres . . . worth working.”¹⁸²

Cardon dealt in domestic as well as imported hides and was alert to all possible sources of supply. He wrote to William Jenkins in 1822:

When coming back from Pha. . . Mr. John Wilcox . . . mentioned that he thought you would get this season 2000 Slaughter hides more than you wanted, and that you probably would have some to dispose of.¹⁸³

Despite Cardon’s efforts to trade in Baltimore and New York, Philadelphia remained the main source of raw hides. Samuel and Frederick Faring (or Foering), George Flomerfelt, Eldridge and Brick, John Vaughan, and Timothy Abbott were the principal suppliers, and, with the exception of Vaughan, all were curriers who at one time or another handled Cardon’s leather.

Equally as important as the acquisition of raw hides was the problem of procuring tanbark. To solve it Cardon and Company (as did other tanners) operated a bark mill as an integral part of their business, filling their own needs for tannin as well as supplying quercitron for the dye trade. From 1820 to 1822, Cardon’s best customer for ground bark was Robert E. Griffith, merchant of Philadelphia. In March 1821, Griffith agreed for one year to take “all the Quercitron or black oak Bark, that they may or can manufacture . . . at their mill on the Brandywine River.”¹⁸⁴

It was Cardon’s opinion that his mill could “grind the bark better and quicker than any establishment of the kind we know,”¹⁸⁵ because “our Way of grinding the Bark” was “on a much better plan” than any other.¹⁸⁶ This improved method was simply grinding “under stones the same as a grist mill.”¹⁸⁷

¹⁸¹ Letter book, Cardon and Company to Nixon Wilson, August 7, 1819.

¹⁸² Letter book, to Samuel and Frederick Faring (Foering), July 7, 1819.

¹⁸³ Letter book, January 28, 1822.

¹⁸⁴ Agreement with Robert E. Griffith for delivery of bark, ground; March 29, 1821, in Griffith Correspondence (OSOR, box 127).

¹⁸⁵ Letter book, Cardon and Company, November 9, 1820.

¹⁸⁶ Letter book, October 28, 1820.

¹⁸⁷ Letter book, October 2, 1820.

In the Delaware region, the bark of the black or quercitron oak, the white oak, and the red or Spanish oak were the common tannin yielders. In addition to oak, hemlock, sumac, willow, cherry, and horse chestnut yielded tannin.¹⁸⁸ Bark supplies were usually purchased in the spring, but out-of-season purchases were often made if the price was right. Once again it was the currier who was in a favored situation. Bark dealers demanded cash, and in the bark season it was customary "for the Tanners to claim some assistance from the Curriers."¹⁸⁹ In his ten years of operation Cardon was forced to borrow heavily from each currier with whom he dealt:

We have now to ask you a favour, which we hope you will not deny us as on it depends entirely our getting our supply of bark this season. We want 1500 Dolls. for that purpose, and rely upon your constantly liberal dealing with us to advance us that sum in 3 different notes at 90 days. Say one of 535.06, one of 485.25 & one of 479.69 the whole amt. of which you shall receive in leather between this and the latter part of May.¹⁹⁰

The dependence was real since Cardon admittedly had no other means of purchasing bark. Thus, the city currier often acted as the tanner's purchaser, sales agent, and financier.

Southern Delaware was the center of the state's bark industry, and most of the bark used at Hagley came from there. Each year Cardon went "down the Delaware for the purpose of getting some bark,"¹⁹¹ visiting dealers in Milford, Smyrna, Georgetown, Milton, and Camden; occasionally he made inquiries at Cantwell's Bridge.

At times Cardon was forced to buy in Philadelphia, because "Some of the People below do not stick to their contracts for bark as well as they ought to." Nevertheless, most of it came from "below." For example, in two years Cardon purchased \$6768.09 worth of bark from Joseph Oliver of Milford, and during the course of ten years bark prices averaged between \$8 and \$15 a cord. Cardon paid \$23 a ton for "bl[ack] oak bark shaved, that is ready to manufacture," and after grinding he sold the quercitron for \$42 a ton. Delivery was effected in many ways, and, on one occasion, a Philadelphia merchant was told: "Should you desire to have the Quercitron delivered at the mouth of the Creek, we would be willing to do it, and provided we were positively apprized of the time you

¹⁸⁸ Morfit (see footnote 41), chapters 6 and 7.

¹⁸⁹ Letter book, Cardon and Company, May 12, 1823.

¹⁹⁰ Letter book, April 28, 1820.

¹⁹¹ Letter book, November 28 1817.

Vessel would come down, we would have ready the quantity wanted." In this manner quercitron was shipped to England from Hagley in the 1820's.¹⁹²

Most of the practical problems encountered by the Hagley tannery involved transportation—getting bark to their mill. The bark industry was closely connected to the shallop trade on the Delaware River, and at times boats were difficult to procure. On arrival in Wilmington they had to be met by wagons and drivers who carted the bark to the Brandywine above tidewater. This required coordination, and boat captains were frequently asked to send "one of the Crew" to Hagley so that "we may look for the Teams." It was Cardon's experience that in a flour milling city one "could procure . . . teams more easily before, than during harvest."¹⁹³

Through the ten years of operation, letters such as the following were commonplace:

Our Stock of bark being nearly exhausted, the object of this is to request you to send on as soon as possible the 50 cords . . . which you promised to send up as soon as boats could be procured, which must be the case now, as they no doubt had since the opening of the navigation, time enough to make 2 or 3 trips either to the City or to the Mills with the grain taken in at your place during the Winter.¹⁹⁴

A new concern, in a highly competitive business, consistently found bark the most difficult raw material to obtain.

Other materials were used by the tannery but in less bulk. Oil of vitriol (sulfuric acid), lime, and dyestuffs were purchased; and du Pont de Nemours and Company provided various services, including blacksmithing, millwrighting, and wagoning. Titus Mosely did the wagoning, William Murphy the millwrighting, and, generally speaking, the tanners found du Pont a great convenience, either to conduct business for them in Philadelphia, to secure credit, or to provide transportation.¹⁹⁵

To tan morocco leather, Sicilian sumac was purchased along with such dyes as Nicaragua wood (black), silver-gray cochineal

¹⁹² Letter book, May 13, 1818; Invoice of Bark . . . on account of A. Cardon by Joseph G. Oliver & Co., 1822-1823 (OSOR, Tannery, box 1); letter book March 12, July 23, 1821; and Robert E. Griffith to A. Cardon and Company, March 31, 1821, Griffith Correspondence (OSOR, box 127).

¹⁹³ Letter book, Cardon and Company, June 28, 1821.

¹⁹⁴ Letter book, Cardon and Company, March 26, 1822.

¹⁹⁵ Hagley Shop ledger, 1813-1837 (OSOR, Gunpowder, misc.); letter book, Cardon and Company, et passim. All of the Cardon and Company accounts reflect the concern's dependence upon E. I. du Pont de Nemours and Company.

(Castilian red), barberry (yellow), and indigo to give it the desired color. These materials were purchased from Meggeson Laplante and Company or Samuel Wetherill and Sons, of Philadelphia, or from Anthony Girard in New York.¹⁹⁶ Within the Brandywine milling community, Cardon supplied "Leather for [the] powder yard," as well as belt leather to textile millers William Young, Victor and Charles du Pont and Company, Duplanty, McCall and Company, and John Siddall.¹⁹⁷ Cardon also sold these firms dye drugs and bark, presumably quercitron. Besides this, the textile manufacturers purchased fleshings and remainders for glue, plus hundreds of bushels of hair.¹⁹⁸ In 1817, even "The Sunday School society" purchased ten and one-half bushels of hair from the tannery, but for what purpose is not clear.¹⁹⁹

Generally, the tannery at Hagley operated exactly as did other leather factories. It produced the same product, used the same raw materials, utilized the same transportation facilities, and traded in the same market. Aside from an accelerated process of manufacturing leather (which at the time was of questionable value), A. Cardon and Company was a typical early nineteenth-century tannery, suffering most of the stringencies of the period.

Following the depression of 1819, Cardon complained of the "depreciated state of leather" and of "the scarcity of Money." His correspondence was gloomier still in 1822, and after the failure of two customers, he wrote that "the profits are already scant enough on leather . . . [so] secure the most you can of our share as well as yours, and of course you had better take 10 shillings per pound than nothing at all."²⁰⁰

Earlier he had told one concern that it was "utterly impossible for us to send you any cash at present."²⁰¹ By the end of 1824, the

¹⁹⁶ Letter book, Cardon and Company to Anthony Girard, December 2, 1816; and to Meggeson Laplante and Company, December 9, 1816, *et passim*. In addition see day book, 1815-1822, Cardon and Company, December 31, 1816; June 11, 1817; December 31, 1817; *et passim*.

¹⁹⁷ For leather sold to the gunpowder yards see E. I. du Pont de Nemours and Company in account with A. Cardon and Company, June 30, 1821, in accounts current, Cardon and Company, 1815-1827. For belt leather sold to Brandywine textile manufactures see ledger, Cardon and Company, 1816-1825, May 5, 1817 (Wm. Young); July 9, 1817 (V. & Ch. du Pont); July 5, 1817 (Duplanty and McCall); January 3, 1821 (John Siddall).

¹⁹⁸ See the accounts of the above mentioned cotton and woolen millers in day book, Cardon and Company, 1815-1822, and ledger 1816, 1825.

¹⁹⁹ Day book, 1815-1822, December 31, 1817.

²⁰⁰ Letter book, April 19, 1820, to G. and H. P. Shannon; December 20 1822, to Timothy Abbott and Company.

²⁰¹ Letter book, June 20, 1822.

future of the tannery on the Brandywine was not bright. Cardon had extended his resources and his credit to the breaking point. Constant borrowing to buy bark, to purchase hides, or to expand the business had pushed the concern deeply into debt. The cost of bark and hides had never been higher and the price of leather was low. In 1824, "embarrassment began to be evident A. Cardon used the signature of the firm to accept some drafts of his personal creditors to the amount of \$4000 which he paid out of the funds of the concern, or to speak more correctly by contracting new debts in the name of the concern."²⁰²

Things went from bad to worse, and by the spring of 1825 Cardon and Bidermann agreed "to finish tanning what was on hand in order to bring the concern to a close." In the same year, Cardon left Hagley and moved to Harrisburg, Pennsylvania, where he had "been offered great advantages" to manage a tannery for Eldridge and Brick and Company—a concern to which Cardon and Company owed well over three thousand dollars.²⁰³

In November he wrote from Harrisburg that he had agreed to give Eldridge and Brick the tan vats at Hagley in "partial payment of our debt." This met with objection on the part of E. I. du Pont, who apparently was to pay the cost of transportation for the equipment from the Brandywine to Harrisburg. The vats were ready for shipment when du Pont balked. Such stubbornness was interpreted by Cardon only "as Mr. Victor says . . . when one loses one is in bad humor." Realizing this, Cardon desired "to finish as soon as possible the business on the Brandywine."²⁰⁴

The situation was so confused in the next several months that in Cardon's absence no one was competent to judge when leather was to be taken from the tan vats. In January of 1826, a Philadelphia concern was informed:

Our Mr. Cardon is not here at present. We understand from him that some of the leather tanned is yours, but we think that he meant to wait to send it till the whole of what belongs to you should be ready in order to settle at the same time for the exp[ens]es of tanning. Any how in his absence we do not know your leather and we shall have to wait his return which is to take place in a couple of weeks.²⁰⁵

²⁰² "Statement written by Bidermann," B. G. du Pont, vol. 11, p. 254.

²⁰³ Ibid.

²⁰⁴ A. Cardon to A. Bidermann, November 13, 24, 1825, Cardon Correspondence, (OSOR, box 56).

²⁰⁵ Letter book, January 7, 1826, Cardon and Company to William and James Pritchett. See also letter dated March 11, 1826, to Eldridge and Brick.

Statement of the Articles taken from St. Cardon & Co. by and on acc ^t of Eldridge and Brick.	
1 Large Crane to haul the Lines -	\$ 27.00
4 Frames to hang the Hides in the line - - -	8.00
1 Small Crane with gearing &c. - - -	21
10 Brass Coats - - - at - - -	50.00
2 grinding stones with spindle pulleys, and boxes to run on -	23 00
A Chain to haul the Hides for the Lines Block	07.
1 Saw Forks - - - - -	00. 30
2 rollers with the spindle, bolts, and pins - -	25
25 Cart bags	
	121.00
	\$ 127.50

Figure 24.—Statement of Materials Taken from Cardon and Company, 1826. Claimed in partial payment of debt, the materials listed on the statement reproduced here are similar to those pictured in figure 25.

While some worried about their leather, others wanted money, including Eldridge and Brick, the firm which Cardon left Hagley to join. Instead of cash, however, they received the following:

It would be . . . wrong in us to lose any time in informing you that it will not be in our power to settle for the balance . . . in the short time you seem to wish it, nor in the manner proposed. It is with much surprise that we learn that our Mr. Cardon has offered you Messers. Du Pont's accept[ance] for the same, as in fact far from having any claims against this gentle[man], our concern is already to a large amount in their debt. We are now engaged in closing the accounts of our concern and have to request of you the indulgence of sum [sic] time for the settlement of the balance due you.²⁰⁶

²⁰⁶ Letter book, January 7, 1826, Cardon and Company to William and James Pritchett.



Figure 25.—The Physical Assets of a Tannery. Tools, beams, and vats, as illustrated in Lalande's "Art du Tanneur."

In short, as a correspondent was later informed, "when Mr. C removed from here to the Neighbourhood of Harrisburg, he left the remaining partner without any adequate means to pay the heavy claims ag[ainst] the concern."²⁰⁷ By 1826, creditors began to claim equipment from the tanyard at Hagley, and for all practical

²⁰⁷ Letter book, August 5, 1827, to F. Faring.

purposes the operation of the firm had come to an end.²⁰⁸ (See figs. 24 and 25.)

Following the example of E. I. du Pont, Cardon had constantly expanded his business by borrowing, enlarging his physical plant, and striving to increase his sales. The great difference was that good gunpowder was at a premium whereas fine leather was a surfeit in the market. Gunpowder mills were rare, tanneries were not; the former properly managed could not fail to succeed, the latter, even with divine management, would have been hard pressed. A more cautious, perceptive individual might have successfully prolonged the life of the firm, but it would have been only a question of time until an expanding line of powder mills had pushed the Hagley tanners from the banks of the Brandywine. In 1809, E. I. du Pont had warned that the region was crowded with tanneries and that there was room for no more. By 1826, he had been proved correct. There remained only the formality of ending the partnership and the larger task of closing the accounts.

The actual dissolution was delayed so that the creditors would not present all their claims at once. In May 1830, the following document²⁰⁹ was drawn (see fig. 26):

Dissolution of Partnership

Notice is hereby given that the Partnership formerly existing between Alexander Cardon, James Anthony Bidermann & Charles Dalmas in the business of Tanning leather and grinding Bark, and which was carried on under the firm of A. Cardon & Co. was duly dissolved on the first day of June A. D. 1826 at which period said Partnership ceased and has not since been continued or renewed.

Wilmington, Delaware
May 20 A. D. 1830

James Anthony Bidermann
Charles Dalmas
A. Cardon

²⁰⁸ Statement of the articles taken from A. Cardon and Company by and on account of Eldridge and Brick (June 1826), in bills miscellaneous (OSOR, Tannery, box 1):

- 1 Large Craine to Haul the Limes
- 4 Frames to hang the Hides in the lime
- 1 Small Crane with gearing (to hang hides in the lime)
- 10 Brass Cocks
- 2 Grinding stones with Spindle pulleys and boxes to run on
- A Chain to haul the Hides fr. the limes block
- 1 Tan Fork
- 2 Rollers with the Spindle, balts, and pinions
- 25 Bark bags
- 1 Crank and 2 pulleys

In addition, see Cardon and Company to Eldridge and Brick, July 16, 1826, in letter book.

²⁰⁹ OSOR, P. S. du Pont Collection.

Dissolution of Partnership

Whereas it has been seen that the Partnership
formerly existing between Alexander Cardon Tannery, brother
Bidermann & Charles Dalmas in the business of Tanning
leather and grinding bark and which was carried on
under the firm of A. Cardon & Co. was duly dissolved on
the first day of June A. D. 1830, at which period the
said Partnership ceased and has not since been continued
or renewed.

Helmington Del.
May 20th A. D. 1830

James Anthony Bidermann

Chas. Dalmas
A. Cardon

Figure 26.—Dissolution of Partnership, 1830. The life of A. Cardon and Company officially ended with a dissolution of partnership in May 1830. This document is a part of the nearly complete business record of the tannery preserved at the Eleutherian Mills Historical Library, Greenville, Delaware.

From 1826 to 1829 confusion cleared and tempers cooled and the books were brought up-to-date. The tally showed that in slightly over ten years the firm had lost \$43,303.03. Of this, \$33,440.92 was owed to E. I. du Pont de Nemours and Company as follows: by Bidermann, \$11,059.56; by Cardon, \$10,769.63; and by Dalmas, \$12,321.94.²¹⁰

When the accounts were finally closed, Bidermann "or his friends" had paid debts for the tannery amounting to about

²¹⁰ Statements of profit and loss 1, 2, and 3, from the books of A. Cardon and Company, 1816 to 1829, OSOR, Tannery, box 1.

\$35,000. He "continued to settle with the creditors" until only a small sum remained unpaid. All of Bidermann's payments were based on the supposition that Cardon was without funds, which in fact appears not to have been the case. By 1829, Cardon had over \$40,000 invested in an iron furnace in Dauphin County, Pennsylvania. Charles Dalmas, the silent partner, was absolved from responsibility and lost "only the \$2000 he originally put in the stock."²¹¹

How had Bidermann paid the debts of the firm, and who were his friends? Actually it was quite simple: the money came from the du Pont Company, and E. I. du Pont was the friend who concurred in such a procedure. When the books of the powder company were audited in 1834, the debt of the tannery after absorbing all outstanding obligations was listed as \$55,148.92.²¹² Unlike the debts of the Hagley cotton and Louviers woolen-mill ventures, this financial obligation was assumed by Bidermann and not by E. I. du Pont. When E. I. du Pont's estate was divided, the tannery was clearly listed as a du Pont Company deficit—one for which Bidermann took full responsibility. The debt of A. Cardon and Company was subtracted from Bidermann's total assets in the powder company, which, after the \$55,148.92 tanning loss was deducted, still amounted to \$86,517.16.²¹³ Thus the losses of the tanning venture were temporarily assumed by E. I. du Pont de Nemours and Company.

With the accounts settled, the Hagley tannery was quickly forgotten. Of the original partners only Bidermann remained on the Brandywine, where for a time (1834–1837) he became the head of E. I. du Pont de Nemours and Company. Of the physical plant only a single stone building remains to document the activities of Cardon and his associates. To revive Delaware's sagging leather industry, and indeed the country's in general, only time was needed. The first quarter of the nineteenth century had been difficult indeed, but by the 1850's there was a resurgence. Leather factories replaced the antiquated but more picturesque tanyards, and empirical methods gave way to a more advanced industrial technology. It was the lot of A. Cardon and Company to have heralded the change.

²¹¹ "Statement written by Bidermann," in B. G. du Pont, vol. 9, pp. 255–257; for Cardon's activities after leaving the Brandywine, see McLane Report, vol. 2, pp. 196, 228.

²¹² See journal, 1832–1834, E. I. du Pont de Nemours and Company, November 1, 1834, OSOR.

²¹³ Antoine Bidermann to brothers and sisters, March 1, 1837, Allan J. Henry Collection, box 16, Eleutherian Mills Historical Library.

Appendix

The Process of Tanning in 1764

(From *A New and Complete Dictionary of the Arts and Sciences; Comprehending All the Branches of Useful Knowledge*, vol. 3, pp. 3154–3155.)

Method of TANNING oxen-hides. The skin being flayed off the carcase, if it is intended to be kept, is salted with sea-salt and alum, or with a coarse kind of saltpetre. If it is not for keeping, the salting is saved, as being of no use but to prevent the hide from corrupting before it can be conveniently carried to the tanhouse. Whether the hide have been salted or not, the tanner begins with taking off the horns, the ears, and the tail, after which it is thrown into a running water for about thirty hours, to wash off the blood and other impurities adhering to the inside. This done, it is laid over night in a lime-pit, already used, whence it is taken and left to drain three or four days on the edge of the pit. The first and slightest preparation over, it is retained into a strong lime-pit for two days, then taken out for four days more; and thus for six weeks alternately, it is taken out and put in twice a week. At the six weeks end it is put into a fresh pit, where it continues eight days, and is then taken out for so many, and thus alternately for a year or eighteen months, according to the strength of the leather and the weather; for in great heats they put in fresh lime twice a week; and in frost they sometimes do not touch them for three months. Every fresh lime-pit they throw them into, is stronger and stronger. At the end of four, five, or six weeks, the tanner scrapes off the hair on a wooden leg or horse, with a kind of knife made for that purpose. And after a year or eighteen months, when the hair is perfectly gone, he carries it to a river to wash, pares off the flesh on the leg with a kind of cutting knife, and rubs it briskly with a sort of whetstone, to take off any remains of flesh or of filth on the side of the hair. The skin is now put into tan, that is, it is covered with tan as it is stretched in the pit, and water is let in upon it; if the skin is strong, five coverings of tan will be required; for weaker, three or four may suffice. When the skin has not been kept long enough in lime, or in the tan-pit, upon cutting it in the middle there appears a whitish streak, called the horn or crudity of the skin, and it is this crudity that is the reason why the soles of shoes, boots, &c. stretch so easily and take water. When the hides are sufficiently tanned, they are taken out of the pit to be dried, by

hanging them in the air; then the tan is cleared off them, and they are put into a place neither too dry nor too moist; they are there well stretched over one another with weights a-top, to keep them tight and strait; and so this condition are sold under the denomination of bend-leather. This is the method of tanning bullocks or oxen-hides. Cows, calves, and horses skins are tanned much after the same manner of those of oxen, except that they are only kept four months in the lime pit, and that before they be put in the tan, there is a preparation required thus: cold water is poured into a wooden vat, or tub, wherein the skins are put, which are kept stirring while some other water is warming in a kettle; and as soon as that water is little more than luke-warm, it is poured gently into the vat, and upon this is cast a basket of tan; during which time the skins are still kept turning, that the water and tan may not scorch them. After an hour they are taken out and cast for a day into cold water, then returned to the former vat and the same water they had been in before, and here they are left for eight days: which expired, they are put into the tan-pit, and three coverings of tan given them; the first of which lasts five weeks, the second six, and the third two months. The rest of the process is the same in all respects as that delivered above.

The Process of Tanning in 1813

(From Thomas Martin, *The Circle of the Mechanical Arts*, pp. 542-546.)

TAN, tannin, or the principle that effects the operation of the art of tanning, is usually produced from the bark of oak, chopped and ground in a mill into a coarse powder. M. Deyeux was the first chemist who ascertained and gave an account of the peculiar nature of tan. He pointed it out in his analysis of nut-galls, as a peculiar resinous substance, but without assigning to it a name. Seguin, who ranks high in France, as a chemist, and as one who has entered deeply into the principles of tanning, though not so much regarded by the tanners in England, engaged in a very extensive set of experiments on the art of tanning leather, during which he discovered that *tan* has the property of precipitating glue from its solutions in water, and also of combining with skins of animals. This led him to suppose it the essential constituent of the liquids employed for the purpose of tanning leather, and hence arose the

names *tan*, *tannin*, and *tanning principle* given it by the French chemists. To M. Proust, however, we are indebted for the investigation of the nature and properties of tan, and of the methods by which it is obtained in a separate state. Much curious and important information has been obtained by the experiments of Sir Humphry Davy, on the constituent parts of astringent principles, and on their operation in the business of tanning, and to the papers of that gentleman, which we understand are founded on practice, we shall be chiefly indebted for the rules hereafter given, as guides to the English tanner.

Tan exists in a great number of vegetable substances, but it may be procured most readily, and in the greatest purity from nut-galls and catechu. Nut-galls, are, as most of our readers know, excrescences formed on the leaves of the oak by the puncture of an insect which deposits its eggs upon them. The best are known by the name of Aleppo-galls, imported in large quantities into this country for the use of dyers, calico-printers, &c. They are hard like wood, round, often nodulated on the surface, of an olive-green colour, and of an excessively disagreeable taste. They are, in a measure, soluble in water, and what remains is tasteless, and possesses the properties of the fibre of wood. A very great proportion of water is necessary to carry off everything soluble. It has been ascertained that one hundred and fifty English pints of water are necessary to carry off whatever is soluble in a pound troy-weight of galls. The soluble part of nut-galls consists chiefly of five ingredients, viz, tan; extract; gallic-acid; mucilage; and lime: but tan constitutes more than two-thirds of the whole. Hence the importance of nut-galls and oak-bark in the art of tanning, of which the following is a brief description.

Hides quickly become putrid when in a moist or wet state, but may be preserved for a great length of time by being perfectly dried, but then are hard like horn, and not fit for any useful purpose. These inconveniences are obviated by tanning, and they then take the name of leather. To tan a hide, is to saturate it with tannin, or the astringent principle of vegetables, and by that means, to render it incorruptible. We shall not here dwell upon the theories by which the operations and the effect of tanning have been explained; but shall content ourselves with observing that M. Seguin has shown that the tannin unites itself with the gelatine which forms almost the whole of the hide, and that there thence results a new substance possessing properties altogether distinct. In order to prepare a hide for receiving the tan, it is necessary to begin by removing the hair, separating the adhering

pieces of fat, &c. These preliminary operations are performed in the following manner:—

When the hides, which are to be tanned, are raw (in which state they are called green hides), they are put to steep in water, in order to clear them of the blood and filth they may have collected in the slaughter-house. They are left to soak in the water for some time, and if the hides are dry, they are steeped a longer time, sometimes for fourteen days; less in hot weather, or more in cold. They are drawn out once or twice to see if they are well softened. The neighbourhood and the command of water are necessary to these operations. Without that the hides cannot be prepared.

After the hides have been well softened they next proceed to cleanse or free them from the hair. With this intention several different methods are employed; that which is the oldest, and still most generally followed, consists in the application of lime. In all tanneries, pits are formed underground, having their sides lined with stone or brick, in which lime-stone is slacked so as to form milk of lime. These pits are divided into three kinds, according to the greater or less strength of the lime. The hides intended to be scoured are first put into the weakest of these pits, wherein they are allowed to remain until the hair readily yields to the touch. If this liquor be not sufficiently active, they are removed to the next in graduation. The time they are soaked is longer or shorter in proportion to the strength of the lime, the temperature of the air, and the nature of the hides. It has been proposed to substitute lime-water in place of the milk of lime. But, though the lime-water acts at first with sufficient strength, its action is not sufficiently permanent, and, in order to succeed in clearing the hides by this means, it is necessary to renew it occasionally; and in this way the hides may be prepared in a few days. In some tanneries, after they have been kept in the pits for a short time, they pile them up in a heap on the ground, in which state they are suffered to remain during eight days; after which they return them into the same pits from whence they were taken, and this process is repeated till the hair can be easily scraped off.

In many countries they mix a large quantity of ashes with the lime; but the only effect this mixture appears to produce is that of rendering the leather less consistent than when lime is solely employed. Many attribute the bad qualities of leather to the too great use of lime, which has a tendency to burn and render it brittle. Hence, in several well-conducted tanneries,

in manufacturing leather for some particular uses, the employment of lime is carefully avoided. Hides may, indeed, be cleansed by subjecting them to an incipient fermentation, which may be produced in a variety of ways. But in whatever manner the first part of the operation has been conducted, as soon as it is perceived that the hair is in a fit state to be removed, it is scraped off, on a wooden horse, by means of a crooked knife, which is not so sharp in any part of its edge as to injure the hide, or, by a whetstone. This operation is not only intended to remove the hair, but likewise the scurf and filth which collects on the skin at the root of the hair.

After removing the hair and filth, the next object is to free the hides from the adhesion of any part of the muscle, or fat, and to render them soft and pliant. Those which are intended for particular kinds of work, such as calves' skins for the upper leather of shoes, and neats' leather for shoulder-belts, do not require to be raised or swelled. As soon, therefore, as they are cleansed and freed from the flesh, &c. they are laid in a pit. The hides intended for the soles of shoes, and other strong leathers, are afterwards raised by means of processes which vary in different countries. When lime is employed, the operation is commenced by putting the cleansed skins into the weakest of the lime pits, and another in the strongest. During this operation care is taken to withdraw them, and pile them up in a heap, every two or three days, putting them again into the pit after it has been well stirred. Lime hardens the skin, and in those tanneries where it is used, the hides are put into a ley of pigeons' dung in order to soften them, and this process is termed graining. They are daily withdrawn from the ley, and laid up in a heap for half an hour. This operation is usually continued for ten or fifteen days. Sometimes also acid compositions are employed for raising the hides; and this operation is greatly accelerated by using the acids warm, as well as by the method practised in this country, of removing them from a weaker liquor into a stronger, until they be properly raised or swelled.

The skin being thus prepared, is next subjected to the operation of tanning; and to this purpose vegetable astringents are employed. Those vegetables answer best which contain the greatest portion of the astringent principle, now known under the name of tannin. Mr. Davy has demonstrated that caoutchoue or Japan earth, contains more of this principle than any other vegetable with which we are acquainted, but oak bark is the substance most commonly employed in our climates; for it is not only very abun-

dant in Europe, but likewise contains much tannin. Every species of oak, however, does not supply us with bark of the same quality; the white oak is inferior to the green oak which grows in the south, while this in its turn yields in the value of its bark to that procured from the roots of the kermes-bearing oak, which is employed in southern climates for tanning strong leathers. But whatever kind of bark be employed, it is previously ground down to powder. The tan-pits are sometimes of a round, and at others of a square form, dug out to a considerable depth in the earth, and lined with wood or masonwork; their size being in proportion to the extent of the works. The method of tanning is different in different countries.

According to calculation, from five to six pounds of tan is required to each pound of strong leather; and one hundred weight of hides yields from fifty-two to fifty-six pounds of leather.

It appears that the operation of tanning is nothing more than combining the tannin, or astringent principle with the gelatin, which is the basis of the skin, and all the manipulations of the art are directed to effect or facilitate this combination. We will now detail another method chiefly taken from Mr. Davy's memoir on the subject.

After the skin has been cleaned, it is submitted to other operations before it is immersed in the tan liquor. According to Mr. Davy's account of the practices of the art, the large and thick hides which have undergone incipient putrefaction, are introduced for a short time into a strong infusion of oak bark, and after this they are acted on by water impregnated with a little sulphuric or acetic acid; in consequence of which they become harder and denser than before, and fitted after being tanned, for the purpose of forming the stouter kinds of sole leather. The lighter and thinner skins are treated in a different manner: they are macerated for some days in a ley formed from the infusion of pigeons' dung in water, which contains a little carbonate of ammonia; the skin is thus deprived of its elasticity, and becomes more soft.

The tanning liquor is prepared by infusing bruised oak bark in water; and skins are tanned by being successively immersed in such infusions, saturated in different degrees with the astringent principles of the bark. The first leys in which they are immersed are weak, but towards the completion of the process they are used as strong as possible; and in preparing stout sole leather, the skins are kept in an ooze, approaching to saturation, by means of layers of oak bark.

The infusion of oak bark, especially that obtained by the first maceration, contains principally tannin and extractive matter; the gallic acid, if present, as has been supposed, being at least in an inconsiderable proportion. In the course of the maceration of the skins in these liquors, the tannin combines gradually with the gelatin, which, in an organized form, principally constitutes the skin, and forms with it a compound insoluble in water, dense and impermeable to that fluid, while it possesses at the same time a certain degree of elasticity. The extractive matter also enters into the combination; for when skin in a large quantity has exerted its full action on a small quantity of infusion, it at length abstracts the whole dissolved matter, and renders it colourless. From this extractive matter colour is derived, and the skin may perhaps be rendered more dense.

It has been supposed, that the gallic acid frequently contained in vegetable astringents, facilitates the action of their tanning, in converting skin into leather. According to the theory of the operation, as given by Seguin, skin is gelatin in a hardened state from slight oxidizement; the gallic acid in some measure de-oxidizes it, and hence reduces it to that state in which it combines more easily with gelatin. There is little proof given, however, of this theory; and it appears sufficiently established, that the operation can be performed without the presence of this acid; and indeed in the tan liquor prepared by one maceration from oak bark it is scarcely discoverable, and, if it does exist in it, it is in intimate combination with the extractive matter.

The operation of tanning, as now described, requires a number of months, from the skins being successively and slowly introduced into infusions of different degrees of strength. Seguin, after his discovery of tannin, proposed to abridge the process by introducing the skins more speedily into strong infusions of the tanning substance; and in this way, according to the excellent report given on the art of tanning by Pelletiere and Lelivre, in which his method is full described, the whole could be finished in about twenty days, and leather obtained equal in equality to that prepared by the old method. There is reason, however, to doubt of the superiority of this new method. Mr. Nicholson, in some observations on this subject, when a patent was taken out for Seguin's method in this country, stated, that from information acquired from the manufacturers, he found that they had previously been sufficiently acquainted with the powers of the strong tanning infusions; and that it had been even proposed to employ them so as to

abridge the process. But the leather thus prepared was by no means equal to that prepared in the old method. The advantage of the slow and gradual process appears to be, that the whole substance of the skin is penetrated and equally changed; while in the more rapid method the external parts must be more acted on; and the texture probably will be more unequal. It appears also from Mr. Davy's experiments, to combine with a larger quantity of the extractive matter contained in the astringent infusion; and hence too the advantage of the immersions in the weak liquors, as these contain more of this than the strong infusions. It must be confessed, however, that for any thing theory can discover, the common process appears to be unnecessarily protracted, and some advantage might probably be derived from adopting some of the manipulations of Seguin.

The skin in drying increases in weight from the fixation of the vegetable matter: the quantity of this seldom exceeds one-third of its weight. The increase is greater, according to Mr. Davy's experiments from quick than from slow tanning. In the latter, he supposes more of the extractive matter enters into combination, and this weakening the attraction of the skin to tannin, less of it is absorbed, and less vegetable matter on the whole enters into the composition of the leather. Probably, also, in the slow process, more of the animal matter is removed. Other substances are used in tanning, as the bark of the willow, elm, and other trees, and, as we have seen galls and catechu. The leather prepared from these varies in colour, and in some other external qualities.

Catechu, or terra Japonica, as it is sometimes called, is a substance obtained by decoction and evaporation from a species of *Mimosa*, which abounds in India. There are two varieties of it; one from Bombay, and the other from Bengal. This substance is found to consist chiefly of tan, combined with a peculiar species of extract. Tan is chiefly found in the bark of trees, but it has been obtained from the sap, the wood, and even the leaves. It varies in quantity according to the season of the year, and it likewise varies with the age and size of the trees. The greatest proportion of tan is contained in the inner barks. The epidermis usually contains none. The following table exhibits the proportion of solid matter extracted by water from different vegetable substances, and the quantity of tan contained in that solid matter, as ascertained by the experiments of Mr. Davy:

One Ounce of	Solid Matter	Tan
White inner bark of old oak, contains	108	72
..... young oak	111	77
..... Spanish chestnut	89	63
..... Leicester willow	117	72
Middle bark of oak	43	19
..... Spanish chestnut	41	14
..... Leicester willow	34	16
Entire bark of oak	61	29
..... Spanish chestnut	53	21
..... Leicester willow	71	33
Sicilian sumach	165	78
Malaga sumach	156	79
Bombay catechu		261
Bengal catechu		231
Nut-galls	180	127

Of Tawing, Leather-dressing and Dyeing, and other Processes.—The dressing and preparing of the skins of lambs, sheep, goats and other thin hides, though in many particulars closely resembling the method used with the thick cow and ox hides, forms a totally distinct branch of business, and is one in which a good deal of practical skill and nicety of manipulation are required to succeed perfectly. The processes are various according to the article required, and this branch of the manufacture supplies the immense demand of white and dyed leather for gloves, the morocco leather of different colours and qualities for coach-linings, book-bindings, pocketbooks, and thin leather for an infinite number of smaller purposes. Of these the white leather alone is not tanned but finished by the process of tawing, the coloured leather receives always a tanning independently of the other dyeing materials. The previous preparation of each, or that in which the skin is thoroughly cleansed and reduced to the state of simple membrane in which it is called pelt, is essentially the same whether for tawing or dyeing. It is thus performed at Bermondsey, near London, a place long celebrated for all branches of the leather business.

By far the greater number of the skins are imported; if lambs, they are thus prepared; the skins are soaked for a time in water, to cleanse them from any loose dirt and blood, and put upon the beam commonly used for the purpose, which is a half cylinder of wood covered with leather, and scraped on the flesh side with the semicircular blunt knife with two handles, used in this operation. They are then covered with a coat of lime of the consistence of paint,

on the flesh side, and hung up in considerable numbers in a small close room heated by flues, where they remain to putrefy for a given time. During this process a thick slime works up to the surface of the skin, by which the regularity of the process is ascertained, and the wool is loosed so that it readily comes off with a slight pull. Each skin is then returned to the beam, the wool taken off, and all the lime worked off with the knife, and the rough edges pared away. The skin is then put into a pit filled with lime-water and kept there from two to six weeks, according to the nature of the skin, which has the effect of checking the further putrefaction, and produces a very remarkable hardening and thickening of its substance, and probably also it detaches a further portion of the slime. The skin is again well worked, and much of its substance pared down, and all inequalities smoothed with the knife. Pains and judgment are required in these operations on the one hand not to endanger the substance of the skin by the putrefaction, and on the other hand to work out every particle of the lime, of which the least if retained will prevent the skin from dressing well in the subsequent processes, and from taking the dye uniformly and well. The skin is then again softened and freed from the lime. All the thickening produced by the lime is thus removed, and the skin is now highly purified, and is a thin extensible white membrane called in this state a pelt, and is fit for any subsequent operation of tawing or dyeing, or oil-dressing, or shammoying.

The method of bringing kid and goats' skins to the state of pelt is nearly the same as for lambs, except that the lining is used before the hair is taken off, the hair being of but little importance, and only sold to the plasterers; but the lambs' wool, which is more valuable, would be greatly injured by the lime. Kids' skins will take a longer time in tanning than lambs'.

If the pelts are to be tawed they are put into a solution of alum and salt in warm water, in the proportion of three pounds of alum and four pounds of salt to every 120 middle sized skins, and worked therein till they have absorbed a sufficient quantity. This again gives the skin a remarkable degree of thickness and toughness.

The skins are now taken out and washed in water, and then again put into a vat of bran and water and allowed to ferment, till much of the alum and salt is got out and the unusual thickening produced by it is for the most part reduced. They are then taken to a room with a stove in the middle, and stretched on hooks, and kept there till fully dry. The skins are now converted

into a tough, flexible, and quite white leather; but to give them a glossy finish, and to take off the harshness of the feel still remaining, they are again soaked in water and put into a large pail containing the yolks of eggs beat with water. Here the skins are trodden for a long time, by which they so imbibe the substance of the egg that the liquor above them is rendered almost perfectly limpid, after which they are hung up in a loft to dry, and finished by glossing, with a warm iron.

The essential difference, therefore, between tanning and tawing is, that in the former case the pelt is combined with tan and other vegetable matter, and in the latter with something that it imbibes from the alum and salt (possibly alumine), and which is never again extracted by the subsequent washing and branning.

The Morocco leather, as it is called, prepared from sheepskins chiefly, and used so largely for coach-lining, pocketbooks, and the best kind of book-binding, is thus made: the skin, cleansed and worked in the way already described, is taken from the lime-water, and the thickening brought down, not by bran liquor as in tawing, but by a bath of dogs' or pigeons' dung diffused in water, where it remains till supplied, and till the lime is quite got out and it becomes a perfectly white clean pelt. If intended to be dyed red it is then sewed up very tight in the form of a sack with the grain side outwards, and is immersed in a cochineal bath of a warmth just equal to what the hand can support, and is worked about for a sufficient time till it is uniformly dyed. The sack is then put into a large vat containing sumach infused in warm water, and kept for some hours till it is sufficiently tanned.

The skins intended to be black, or any colour but red, are merely sumached without any previous dyeing. After some further preparation, the colour of the red skins being finished with a weak bath of saffron, the skins when dry are grained and polished in the following way; they are stretched very tight upon a smooth inclined board, and rubbed over with a little oil. Those intended for black leather are previously rubbed over with an iron liquor, which uniting with the gallic acid of the sumach, instantly strikes a deep and uniform black. They are then rubbed by hand with a ball of glass with much manual labour, which polishes them and makes them very firm and compact. Lastly, the graining or ribbed surface by which this kind of leather is distinguished is given by rubbing the leather very strongly with a ball of box-wood, round the centre of which a number of small equidistant parallel grooves are cut,

forming an equal number of narrow ridges, the friction of which gives the leather the desired inequality of surface.

The process for the real Morocco leather, as prepared from goatskins at Fez and Tetuan, is thus described by M. Broussonet. The skins are first cleansed, the hair taken off, limed, and reduced with bran nearly in the way already described for the English morocco leather. After coming from the bran they are thrown into a second bath made of white figs mixed with water, which is thereby rendered slimy and fermentable. In this bath the skins remain four or five days, when they are thoroughly salted with salgem, or rock salt alone, after which they are fit to receive the dye, which for the red is cochineal and alum, and for the yellow, pomegranate bark and alum. The skins are then tanned, dressed, supplied with a little oil, and dried.

Much excellent leather, and of various colours, is manufactured in different parts of Russia; of which, the processes are given in Mr. Tooke's "View of the Russian Empire," Vol. III. The saffian, or manoquin, which is prepared largely at Astracan, is manufactured only from the skins of goats and bucks; the usual colours of these are red and yellow. The shagreen, which is also manufactured at Astracan, consists of hides of horses, and asses; but of these only a small part is used, cut from the crupper-line along the back about thirty-four inches upon the crupper, and twenty-eight along the back. The chief dyes of shagreen are green, blue, and black.

Various processes have been invented to render leather for shoes and boots water-tight, which is effected by an additional dressing with an oily or resinous matter: the following recipe is said to be effectual. One pound of linseed-oil; half a pound of mutton suet; six ounces of beeswax, and four of resin, are to be melted, thoroughly incorporated, and applied, while warm, to the upper-leather and the soles.

The Work of the Currier in 1836

(From Edward Hazen, *The Panorama of Professions and Trades*, pp. 67-70.)

1. It is the business of the currier to dress the thinner kinds of leather, which he procures from the tanner in an unfinished state. In most cases, in the United States, except in and near large cities, the business of tanning and currying are usually united in the same

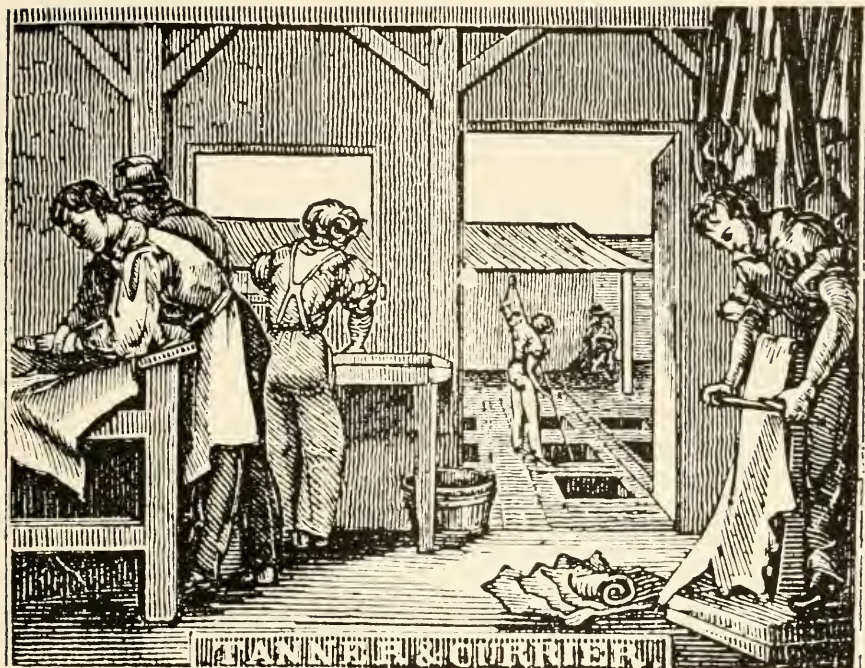


Figure 27.—Tanyard, 1836.

individual; or, at least, the two branches of business are carried on together by the aid of workmen skilled in their respective trades.

2. The mode of dressing the different kinds of skins, varies in some respects; but, as the general method of operating is the same in every sort, a description applicable in one case will convey a sufficiently accurate idea of the whole. We shall, therefore, select the calf-skin, since it is more frequently the subject of the currier's skill, than any other.

3. The skin is first soaked in water, until it has become sufficiently soft, and then shaved with the *currier's knife*, on the inner side, over the *currier's beam*: it is then placed on a table, somewhat inclined from the workman, and scoured on both sides with the edge of a narrow, smooth stone, set in a handle; and again, with an iron *sleeker*, of a similar shape. The skin is next *stuffed* with a composition of tallow and tanner's oil on the flesh side, and then hung up to dry. Afterwards it is rubbed on the hair side, and then hung up to dry. Afterwards it is rubbed on the hair side with a board, and again scraped on the flesh side with the knife. Having

thus been prepared, the skin is blacked on the flesh side with lampblack and tanner's oil, and subsequently rubbed with paste, applied with a brush. When it had been dried, the whole process is finished by rubbing both sides with a glass sleeker.

4. Horse hides are blacked on the hair side, or, as the curriers term it, on the *grain*, with a solution of copperas water. Leather designed for harnesses, for covering carriages, and for other similar purposes, is also blacked on that side in the same manner.

5. The trade of the currier is divided into two or three branches. Some dress only calf-skins, and other thick leather designed for shoes, harnesses, and carriages: others confine themselves to dressing skins, which are to be applied to binding books, and to other purposes requiring thin leather. It may be well to remark here, that the dressers of thin leather usually tan the skins themselves, using the leaves of sumach, instead of bark.

The Process of Making Morocco Leather

(From Julia de Fontenelle and Malepeyre, *The Arts of Tanning, Currying and Leather Dressing*, edit. and transl. Campbell Morfit, 1852.)

Goat and sheep skins are converted by the tanners into *true Morocco*, *imitation Morocco*, *skiver*, and *roan*.

True Morocco—Owing to the comparative scarcity of goats, the tanners use very fresh skins, their supplies being drawn from Switzerland, Germany, Africa, East Indies, and Asia Minor. As imported, they are dry, and covered with hair, and require breaking and softening, which is done by soaking them for several days in water, treading them under feet, rinsing and scraping them on the flesh side to produce evenness. They are then made to pass through three old lime-pits, and after the hair is removed, through a fresh pit, the same precautions being observed, throughout, as in the treatment of calf-skins. This process is continued until the hair can be easily detached, which generally requires about a month, and the skins are then scraped on the beam, reimmersing in lime-milk for two days, and again fleshed with the scraping knife.

Goat skins being of a dry nature, require more rinsing than others, and the operation must be frequently repeated many times in running water.

The unhaired skins are then "bated" with pigeon's, chicken's, or dog's dung, to remove excess of lime. Fermented bran-water is sometimes used as the bate. After being again scraped, the skins are sewed into bag form with the grain side outwards, and partly filled through a funnel with a strong decoction of sumach; they are inflated by the breath, tightly closed, and thrown into a vat containing a shallow depth of weak liquor of sumach, and therein made to float about by means of constant agitation, so as to insure the uniform action of the tan-liquor throughout the surface of the skin. After a few hours, the bags are taken out, and piled upon each other so as to promote by pressure a thorough penetration of the liquor through the pores of the skin, and consequent chemical combination. This process is repeated with new liquor, and the bags are then unstitched, rinsed, and scraped on the beam, and suspended in the drying-loft. These "crust" skins, as they are termed when in this latter condition, are moistened, rubbed out smooth with a copper tool upon a sloping board, and hung up to dry, previous to undergoing the process of coloring. This method tans the goat-skins in one day.

Another plan is to steep the skins for several days in a fermenting mixture of bran-water, scrape them on the beam, and soak and rinse them in clear water. After being limed in the usual manner, they are worked or rubbed over with a tool of hard schist, to press out the lime, smooth down unevenness, and soften the grain, and are then fullled by agitation in a revolving cask, lined within with pegs, and containing water.

The tanning is then effected in the manner before mentioned, two pounds of Sicilian sumach being required for each skin. In France, the tanning is accomplished very much in the same manner as by the fulling above described; the skins are tan-liquor being placed together in a churn-like cask, and the chemical combination promoted by causing it to revolve upon a horizontal axis.

Imitation Morocco—This leather is prepared from *sheep-skins*, in the same manner as true Morocco; except that, after being stripped of wool, they must be subjected to powerful hydrostatic pressure for the expulsion of oleaginous matter, which, being contained in a large amount, would otherwise seriously interfere with the tanning.

They are limed in pits containing 33 pounds of lime for every dozen skins, and are allowed to remain from three weeks to a month. They are then deprived of hair, are resteepped in the pits for five or six days, rinsed, beaten in tubs, and, when perfectly clean, deposited in ooze for a month.

When sheep-skins are tanned for common leather, oak-bark is used instead of sumach.

Morocco is classified in commerce under the head of fancy leathers, because it always reaches market with a highly finished and colored surface on the grain side.

The color is imparted in the same manner as cloth is dyed—by means of the chemical combination of a pigment with a mordant.

Some tanners dye the skins when they reach the state preparatory to going into the tan-liquor, by sewing them together edgewise, with the grain outwards, then mordanting, and afterwards giving them two immersions, of a half hour each, in the dye-bath.

The most common method, however, is to take the tanned skins as they come from the drying-loft, place two together, and then rub them over exteriorly with a brush containing the mordant solution, and afterwards to apply the dye liquor in the same manner. When the dyeing is finished, they are to be rinsed, drained, spread out, sponged with oil to preserve their flexibility, and then sent to the curriers' shop to be finished.

Black—This color is imparted by the application of a solution of red acetate of iron; *crimson*, by a mordant of alum or tin salt, and decoction of cochineal; *puce*, by mordant of alum and decoction of logwood; *blue*, by a solution of sulphate of Indigo; *olive*, by a weak solution of copperas, as mordant, and a decoction of barberry containing a little of the blue bath, as coloring liquor; *violet*, by the consecutive application of decoction of cochineal and weak Indigo bath.

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The records of an actual tanning business bring reality to the study of leather manufacture. At the Eleutherian Mills Historical Library, Greenville, Delaware, the nearly complete business record of A. Cardon and Company survives, supported in depth by the archives of E. I. du Pont de Nemours and Company and by the du Pont family manuscripts. The principal tannery records include: day books, 1815-1822 and 1823-1827; letter book, 1816-1827; accounts current, 1815-1829; plus ledgers, journals, and bills miscellaneous. The *Life of E.I. du Pont from Contemporary Correspondence* (Newark, 1923-1926), edited and translated by Bessie G. du Pont, is to date the most extensive published compilation of the records reflecting du Pont business and family activity to 1834 as well as the endeavors of those closely associated with them.

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